Vol. XIII. July, 1897. No. 1.

PAVING SEWERAGE

MUNICIPAL ENGINEERING

WATERWORKS PARKS

A MONTHLY MAGAZINE.

DEVOTED TO THE IMPROVEMENT OF CITIES.

GOOD ROADS, STREET CONSTRUCTION,
CLEANING AND LIGHTING,
SANITATION,
BRIDGES.

PUBLISHED BY
MUNICIPAL ENGINEERING COMPANY
INDIANAPOLIS NEW YORK

Two Dollars Per Year. Single Copies, 25 Cents.

ASPHALT PAVEMENTS

THE BARBER ASPHALT PAVING COMPANY

BOWLING GREEN BUILDING
No. 11 BROADWAY, NEW YORK

• • ESTABLISHED • •
1878

• • INCORPORATED • •
1883

HIGHEST AWARDS
WORLD'S
EXPOSITION

RECEIVED AT
COLUMBIAN
CHICAGO, 1893

1st. *Asphalt and Asphaltic Cements:* The Refined Asphalt and Asphaltic Cements for Pavements and Asphaltic Mastics are of excellent quality and up to the required standard. They are therefore worthy of an award.

2d. *Trinidad Asphalt Pavements:* The Trinidad Asphalt Pavements for streets, laid according to the several methods by "The Barber Asphalt Paving Company" upon concrete foundations, old stone block and other pavements, are adapted to all climates. They are remarkable for quantity, quality, ease of traction, noiselessness, ease of cleaning, sanitary value, economy of maintenance and handsome appearance, and are worthy of an award.

3d. *Machinery and Processes:* The models, samples, etc., show clearly and fully the Machinery, Processes and Materials for the manufacture of Asphalt Pavements and Mastics. They are worthy of an award.

Municipal Engineering

VOLUME XIII. JULY, EIGHTEEN NINETY-SEVEN. NUMBER 1.

CHEMICAL CONSTITUTION OF RESIDUUMS AND MALTHAS AND ITS RELATION TO WATER ACTION.

By Clifford Richardson.

In connection with the action of water on residuum, it is important to consider the nature of the hydrocarbons of which it is made up and to compare them with those which constitute the asphaltic oils or malthas.

Investigations of these substances have unfortunately not gone so far as to enable us to determine the particular hydrocarbons of which each of these fluxes is composed, but from the relative proportions of carbon and hydrogen found by ultimate analyses of the purified material, and by determination of the relative amount of action of sulphuric acid on them, it can be safely inferred to which series the greater portion of the hydrocarbons in the residuums or malthas belong.

The hydrocarbons, or compounds of hydrogen and carbon, which, mixed in varying proportions, constitute the substances which are known as residuum, maltha and asphalt, belong to different series, so called, which are characterized by the relation of the hydrogen atoms which they contain to the carbon atoms. A short explanation in regard to the nature of these series is necessary for an intelligent understanding and proper consideration of their properties as affecting the character of residuums, malthas and asphalts, which are made up of them.

The carbon atom is characterized chemically as being quadrivalent, that is to say, it possesses four bonds or links by means of which it combines with the atoms of other elements. The hydrogen atom has but one bond and is monivalent.

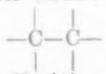
If one carbon atom combines with all the hydrogen atoms that it is capable of, its four bonds must each be linked with a hydrogen atom, and the resulting molecule will consist of one atom of carbon and four of hydrogen, which can be represented by the symbol CH_4, in which C stands for one carbon atom and H_4 for four hydrogen atoms. In this substance or compound, which is known as ethane or marsh gas, we have the carbon atom saturated as to its affinities, or bonds, with hydrogen atoms. It can not combine with any other atom except by replacing one or more of the hydrogen atoms. It is, therefore, known as a saturated hydrocarbon.

If two atoms or three or more atoms of carbon are combined in the same way to form a molecule having C_2 or C_3, etc., in its composition, these atoms, in order to form

a single substance, are themselves linked or bonded together by one or more of the bonds of each atom, so that we may have,

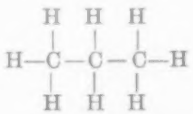
One carbon atom with its four affinities or bonds represented thus:

Two carbon atoms joined by one affinity of each thus:



Or by two affinities of each thus:

In the case of two carbon atoms joined by one affinity each, there are six bonds remaining to unite with hydrogen. The resulting compound with hydrogen in this case is represented by the symbol or formula C_2H_6. It is a saturated hydrocarbon in the same way that CH_4 with one atom of carbon is, because, while two bonds out of the eight of the two carbon atoms are necessarily joined in linking the carbon atoms together, all the remaining available affinities are satisfied by hydrogen. In the same way with three atoms of carbon in the molecules we have the carbon atoms linked to each other, each so that eight affinities out of twelve remain to be saturated by hydrogen thus:



One atom is, of course, linked to two others, and so two affinities of this atom are not available for combining with hydrogen. This saturated hydrocarbon is represented by the symbol C_3H_8.

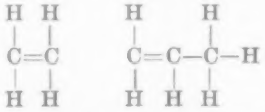
As the carbon atoms increase in number there is found to be a regular increase in those of hydrogen, so that the compounds of this saturated nature become what is called a homologous series differing by one carbon and two hydrogen atoms from the following and preceding,

$$CH_4, C_2H_6, C_3H_8, C_nH_{2n+2}$$

Here is illustrated what is meant by a *series* of hydrocarbons, which is, in this case, the saturated or paraffine series, the one which makes up the greater part of ordinary American petroleum and residuum oil.

In this series, the carbon being combined with as much hydrogen as possible, there is the largest percentage of hydrogen and the smallest percentage of carbon found in any hydrocarbons. For marsh gas, CH_4, the percentage is seventy-five per cent. carbon and twenty-five cent. hydrogen, a proportion gradually diminishing as the number of carbon atoms increases. For example, for $C_{30}H_{62}$ it is carbon 85.31, hydrogen 14.69.

When the carbon atoms in a hydrocarbon do not combine with all the hydrogen atoms they might, the remaining affinities are satisfied in joining the carbon atoms together, in addition to the single bond found in the saturated series. The linking of the carbon atoms is then doubled and the hydrocarbons may be represented thus:



Owing to the double bond, two affinities which, in the unsaturated series, were combined with hydrogen, are now linked with each other and a new series is determined in which the hydrogen atoms number always twice the carbon atoms. The affinities of the carbon are not entirely satisfied with hydrogen, and the hydrocarbons are known as unsaturated

hydrocarbons. As the relation of carbon to hydrogen is constant the percentage composition of all the hydrocarbons of the C_nH_{2n} series is carbon 85.71, hydrogen 14.29, the amount of hydrogen being always less than in any of the hydrocarbons of the saturated series.

In this series but two of the carbon affinities were joined in a double bond. There may be more joined in this way resulting in other series represented by the general formula C_nH_{2n-2}, C_nH_{2n-4}, C_nH_{2n-6}, etc., in which the per cent. of hydrogen is still less.

The hydrocarbons of these series, it is plain, are even more unsaturated.

EFFECT OF THE DOUBLE BOND.

It is a peculiarity of the linking of two carbon atoms together by more than one affinity in each atom, by the so-called double bond, that this bond is not as stable as the single one.

The hydrocarbons of the saturated series are known as paraffines, a name derived from the Latin words "parum"—little, and "affinis"—affinity, because they have proved on investigation to be such very stable bodies, not being attacked or reacting readily with the strongest chemicals, such as acids or bromine.

When the double bond is present, however, the hydrocarbon is easily acted upon by the same reagents which do not affect the saturated compounds. This, of course, is plainly due to the instability of the double bond which readily parts leaving free affinities to unite with the bonds of other elements.

In sulphuric acid of various strengths we have a means of determining to a certain extent the nature of the hydrocarbons in a residuum or maltha, as this acid does not change or attack the saturated or paraffine hydrocarbons, but combines with and removes, or destroys, the unsaturated hydrocarbons, and also, it must be allowed, the sulphur derivatives of these hydrocarbons. The action of acid upon residuum and maltha and a hard asphalt is illustrated by the following determinations:

Substance.	Strength of Sulphuric Acid and Water.					
	% of Bit. Sol. in 88° Naphtha.	1 to 3	1 to 2	1 to 1	Concentrated.	Fuming.
Residuum, Penn.	95.7	91.9	92.2	92.2	86.4	56.9
" Ohio	97.1	96.9	95.1	92.6	86.8	64.1
Alcatraz Maltha	85.2	80.3	77.2	76.0	54.5	27.1
Asphalt, Cal	67.0	59.1	54.3	51.4	44.6	7.3

It is apparent from these determinations that the petroleum residuums consist, to a very large extent, of hydrocarbons, which are not affected by acid and to a much larger degree than Alcatraz maltha or the hard asphalt. In consequence it is but reasonable to suppose that the same relations exist in their ability to withstand the action of water.

The saturated and permanent character of the residuum as com-

pared to the maltha and asphalt is also shown by their ultimate composition.

	Carbon.	Hydrogen.
Residuum after treatment with acid	84.74	15.33
Maltha after treatment with acid	86.86	13.10
Asphalt	88.25	11.75

The residuum has the composition of a saturated hydrocarbon while the maltha and asphalt have that of the unsaturated series.

The conclusions to be drawn, therefore, from a comparison of the chemical constitution of the hydrocarbons of petroleum residuum from the Pennsylvania and Ohio fields with those of the malthas, such as that represented by the Carpenteria deposit, is that, from this point of view, the residuum oils are much the more stable.

COMPARATIVE PRACTICAL VALUE OF RESIDUUM AND MALTHA.

In order to gain some idea of the relative merits of residuum and maltha, or asphaltic oil, for fluxing purposes, some extended experiments have been carried on, both in the laboratory and in connection with the practical side of the industry.

In the laboratory it was found that the solubility of the bitumens of Trinidad and Bermudez asphalts was as great in the ordinary malthas as in residuum. There was no preference in this respect.

When, however, the permanence of consistency of malthas, when exposed to heat, was compared with that of residuums there was found to be a great deficiency in that of the malthas.

Residuum, such as is at present in use, has already been shown to lose only about five per cent. of oil when heated in an open dish in a bath kept at 400° F. for seven hours, and to remain of the same, or very nearly the same, consistency after heating as it was before, being a buttery, viscous liquid. The desirable features of residuum as a softening agent are not altered by continued heating, nor is there a loss of sufficient oil, volatilized at the high temperatures at which asphalt cement is maintained with agitation for considerable periods of time, to change the consistency or, as it is called, the penetration of the cement to any marked degree. As an example a Trinidad lake asphalt cement made on February 29, 1896, by mixing 100,000 pounds of refined asphalt with 2,000 pounds of residuum had a penetration of 55°. It was held over a very low fire in a melted condition for forty-eight hours and then had changed in consistency so little as to penetrate 49°. After seventy-three hours' melting the penetration was 46°. This is an extremely small change for such a considerable length of time.

The malthas or asphaltic oils behave quite differently. On heating for any considerable time they are converted into hard and glassy pitches by volatilization of oil and, perhaps, by some condensation or polymerization of some of its hydrocarbon constituents. Such material is unstable, and can not form a cement which can be maintained at a uniform consistency.

On Saturday, February 29, 1896, in the early morning, 500 lbs. of Bakersfield maltha was added to 2,000 lbs. of refined Trinidad asphalt, or at the rate of 25 lbs. to the 100. After agitation the resulting asphalt cement penetrated 55°. It was allowed to stand with a slow fire until the following Monday morning, March 2. The penetration had then fallen to 25°. On standing another twenty-four hours the penetration was found to be 22°. 270 pounds of additional maltha

was then added, corresponding to 13.5 lbs. per 100, which, after agitation, raised the penetration to 54°. After four hours of heating and agitation a sample was taken and found to penetrate but 35°.

It appears from this experiment that the light California malthas are not suitable for the preparation of an unchangeable cement. Why this is so can be seen in the results of an examination of the maltha in the laboratory. While it is thick enough to require five pounds more of it to every 100 pounds of Trinidad refined asphalt to make a cement of the same consistency that is obtained with residuum, it loses on heating for seven hours to 400° F. 20.3 per cent. This light oil is, of course, volatilized, in the same way though more slowly, from the asphalt cement made with the maltha and the loss causes the rapid fall in penetration and hardening of the cement.

An experiment with one of the ashaltic oils extracted from the abundant supply of asphaltic sandstone rock in Texas, resulted similarly. The asphaltic oil or maltha as received was heated for some time at a low temperature to drive off any water and very volatile oil. A cement was then made of Trinidad asphalt and the maltha, in the proportion of 100 to 80, which had a penetration of 65°. This cement was then maintained for nine hours at a temperature of 325° F., when it was found to have hardened so much as to penetrate but 24°.

Of course satisfactory surface mixtures for paving can not be made with such changeable material, and this is the reason that nearly all the work done with California asphalt has been a failure.

In fact, slight reflection shows that for a fluxing agent for softening a hard asphalt, a substance is needed which does not change its consistency after prolonged heating and not another, though perhaps softer asphalt, which gradually becomes converted into a hard asphalt under the influence of heat.

Some of the relative properties of residuum and the various asphaltic oils are illustrated in the data given in the accompanying table.

PROPERTIES OF VARIOUS FLUXES.

	Residuum.	Malthas.		
	Penn.	Texas.	California.	
			Bakersfield.	Alcatraz.
Specific gravity	.9317	1.0380	.9711	.9955
Flash	425°	329°	280°	270°
Consistency, original at 78° F.	Flows.	Flows.	Flows.	Flows.
Penetration, original at 78° F.	* ∞	∞	∞	∞
Ultimate composition of pure bitumen,				
Carbon	87.96	87.27	84.31	85.72
Hydrogen	12.01	11.79	12.41	11.83
Sulphur	.24	1.13	1 40	1.82
Nitrogen	.09	.23	1.35	1.21
Per cent. of bitumen soluble in naphtha	96.0	92.1	98.0	94.1
Loss in 7 hours. 325° F.	2.96	4.68	17.48	11.85
Loss in 5 hours more at 400° F.	2.15	6.08	9.52	10.30
Loss in the 12 hrs.	5.11	10.76	27.05	21.65
Consistency after heating to 325°.	Soft.	Soft.	Soft.	Viscous
Penetration after heating to 325°.	* ∞	∞	∞	∞
Consistency after heating to 400°.	Soft.	Hard.	Cement	Hard.
Penetration after heating to 400°.	Buttery * ∞	42°	102°	32°
Asphalt cement, Parts of flux to 100 of asphalt necessary	19	75	25	35
Penetration of cement	58°	71°	55°	50°
Penetration after 7 hours 325°	34°	26°	22°	15°

* ∞ Denotes too large to read.

[Other articles by Mr. Richardson will appear in succeeding numbers of MUNICIPAL ENGINEERING.]

ASPHALT EXAMINATION.

By H. Endemann, Ph. D.

The prevailing method of examination of asphalt has brought chemical analysis of asphalt into disrepute, for the reason that the results of such analysis can not be practically applied. Boussingault, over sixty years ago, had recognized in asphaltum two constituents which he had called respectively petrolene and asphaltene. The name petrolene he gave to oily and volatile substances, while he reserved the name of asphaltene for the predominant constituent which he obtained as a non-volatile residue, when the asphalt was heated in air, and which, according to his analysis, contained considerable oxygen. These names have been in use ever since and are so at present, though the meaning of these names has been perverted by reason of the introduction of a new method of analysis.

Clifford Richardson stated, about six years ago, that he could produce the same separation which Boussingault had obtained by distillation, by the use of solvents, especially petroleum-ether, which, according to his statement, would dissolve only the petrolene and leave the asphaltene behind.

Richardson, evidently, never examined his products, but must have been satisfied with his separation merely by the fact that his products did not look alike—his petrolene was somewhat liquid, while his asphaltene was a solid. It evidently did not strike him as peculiar that his results were really opposite to those of Boussingault, inasmuch as in a sufficiently elastic asphalt he invariably found more petrolene than asphaltene, while, according to the originator of these names, the asphaltene must predominate.

After Richardson, others thought to improve on his method by replacing the petroleum-ether by such solvents as alcohol and aceton, but the general results of such analyses did not differ to any extent from those proposed by the originator of this style of analysis.

The difficulty in all of these analyses is that the substances to be determined are not separated from each other at all. What Richardson then called petrolene is really asphaltene with perhaps 30 to 40 per cent. of petrolene, while what he called asphaltene is again asphaltene and petrolene, but not quite so much of the latter. The confusion thus brought about has been the cause not only of remarkable analytical results by others which had no bearing upon the practical applicability of the asphalts, but also of still more astonishing theoretical speculations based upon the former.

One should think that if three different asphalts were analyzed and their composition then corrected by the addition of say heavy petroleum oils, as is done for the preparation of the asphalt cement, that the resulting mixture should show equal or approximately equal quantities of the constituents. This, however, is not so, if the analysis is carried out by any of the liquid extraction methods.

One would think now, that the resulting asphalts, aside from the mineral constituents, should show a certain similarity, if such asphalts were analyzed as to give satisfactory

pavements, after their composition is rectified in the usual manner, or that the additions could be adduced directly from the results of the analyses. This, however, is not so.

Three analyses of Trinidad land asphalt, Trinidad lake asphalt and a Mexican asphalt, all refined, gave, on analysis by the extraction method, the following results:

	Trinidad.		Mexican.
Soluble in petroleum-ether called petrolene	Lake.	Land.	
	31.86	24.97	87.12
Asphaltene	28.12	33.67	10.19
Insoluble and ash	40.01	41.36	2.67

If, for instance, for the manufacture of an asphalt cement from land asphalt we use for 100 of the refined asphalt, 20 of residuum oil for the production of the asphalt cement used for the paving mixture, and if we count the residuum oil all as petrolene, while if the refined Mexican asphalt were used without any addition, the proportions of petrolene to asphaltene in these would appear as follows:

	Trinidad land asphalt cement.	Proportion.	Mexican refined.	Proportion.
Petrolene	44.97	1⅓	87.12	8½
Asphaltene	33.37	1	10.19	1

If we consider the composition of asphalt cement made from Trinidad lake asphalt, where less residuum oil is used, we get about the same proportions as in Trinidad land asphalt. If the analyses were correct, one would have to argue that the substances composing these asphalts must differ completely, notwithstanding the fact that in some other properties there are such great resemblances.

A closer inspection and analysis of these separations showed that there was too great a resemblance in the properties of the petrolene from different asphalts, and it became therefore probable that the differences were largely due rather to the fact that analysis had miscarried and had not produced pure substances but mixtures.

This probability I made to a certainty by showing experimentally that the petrolene obtained by the extraction method contains only from 30 to 40 per cent. real petrolene, while the rest is asphaltene—with other words, a mixture of

65 real asphaltene,
35 real petrolene,

Is completely soluble in petroleum ether.

This so-called petrolene is really a soft or liquid asphalt, which, when examined by chemists using the extraction method, is reported as consisting entirely of petrolene, because it is fully soluble in petroleum-ether. We know now, however, that the substance soluble in petroleum-ether consists mostly of asphaltene in the average about 65 per cent. and only 35 per cent. petrolene. Such liquid asphalts as well as all those which contain less than 65 per cent. asphaltene are, according to these analyses, all petrolene.

Asphaltene	50	40	30	20
Petrolene	50	60	70	80

down to all petrolene show by these analyses fully alike.

Hence such results can not give us any hint as to the applicability of these more or less liquid asphalts for the production of compositions of standard properties as I will explain below.

What, now, is real petrolene and asphaltene?

I call petrolene the inert volatile, oily substances which tend to give to the hard asphaltene the necessary elasticity. They may be separated by distillation.

I call asphaltene the non-volatile,

hard and brittle substance which gives the asphalt its body. It contains oxygen. This asphaltene has the property of absorbing, at a temperature of 250° C., oxygen from the air and of passing into a black non-bituminous substance which I call "asphaltic oxide," or acid, and which is the same as Boussingault's asphaltene. It contains much oxygen.

Many asphalts, especially the liquid, contain in the place of asphaltene, or associated with it, a body which I have called "asphaltogen." It is likewise a solid, but contains no oxygen; it is somewhat volatile, but has the property to pass like asphaltene into asphaltic oxide. This body takes the place of asphaltene and provides body for the asphalt. Asphaltogen is easier softened by petrolene than asphaltene.

These substances I separate and determine in the following manners: I either drive off the petrolene in a current of carbonic acid gas at a temperature of 250° C., and thus determine the quantities of the constituents, or I convert the asphaltene or asphaltogen into asphaltic oxide and from its weight calculate the substances as they occur originally in the bitumen by using coefficients deduced from my investigations.* The latter method is the only one that can be used in the presence of asphaltogen.

The analyses, by my method, of two of the asphalts of which analysis by extraction method were given above, yield results as follows:

	Trinidad Land.	Mexican.
Petrolene	10.54	26.51
Asphaltene	48.10	70.80

The Mexican asphalt can be used as it is. The Trinidad land, however, has to be softened. This is generally done by the addition, not of petrolene, but of petroleum residuum oils of which twenty per cent. are added to obtain a cement of desired elasticity.

The petroleum residuum oils which I have examined contain about twenty-five per cent. of asphaltogen, hence we have:

	Trinidad Land.	
Petrolenes in asphalt	10.54	25.54
Petrolenes in oil	15.	
Asphaltene in asphalt	48.10	53.10
Asphaltogen in oil	5.	

In making the mixture it seems to appear that we have an excess of petrolenes, but this is only apparently so. In the first place, in the manufacture of the cement we loose some of the oil by volatilization—another portion of the excess is needed for the reason that the residuum oil contains oils which do not mix with the asphaltene, and are really not in combination or solution with it. If such a mass is examined closely, it is always found that it contains a softened asphalt intermixed with small cavities filled with liquid oil. The apparently excessive quantity of petrolenes in Trinidad land asphalt cement as compared with the Mexican is thereby sufficiently explained.

It is different if we use petrolene. The mass in this case becomes fully homogeneous, and the quantity of petrolene necessary to produce the softening is considerably smaller—*i. e.*, about one-half of the quantity of petroleum residuum oil required.

Petrolene, however, is not an article of commerce. We must help ourselves in this case by using liquid and soft, natural asphalts, which are rich in petrolene, in combination with those which are too hard.

* For details I refer to my publication in the *Journal of the Society of Chemical Industry*, December, 1896, February, 1897.

In order to produce a standard mixture for cement paving mass from analyzed asphalts, we proceed as follows:

We first ascertain the composition of a bitumen of a pavement, which is considered as standard and which is to be imitated. We will *suppose* this to have a composition as follows :

Asphaltene 73,
Petrolene 27.

The materials at our command are a refined Trinidad asphalt, containing, aside from non-bituminous material,

47 asphaltene,
11 petrolene.

And a liquid asphalt containing aside from 10 per cent. non-bituminous material,

Asphaltene 50,
Petrolene 40.

	Petrolene
100 bitumen of standard contain	27.0
100 bitumen of Trinidad contain.	18.9
100 bitumen of liquid asphalt	44.4

To find now the quantity of Trinidad asphalt bitumen which must be combined with one part of liquid asphalt bitumen to obtain a bitumen of standard composition, or containing 27 per cent. petrolene, I calculate as follows:

$$18.9x+44.4=27(x+1)$$
$$x=\frac{17.4}{8.1}=2.148$$

We require, therefore, 2.148 Trinidad bitumen for 1 of a liquid asphalt bitumen to obtain a cement bitumen of desired composition.

Our raw materials, however, are not pure. They contain considerable non-bituminous material, the refined Trinidad lake asphalt 42 per cent., and the liquid asphalt 10 per cent.

To obtain the quantity of raw material thus required we calculate for Trinidad:

$$\frac{2.148\times100}{58}=3.703$$

For liquid asphalt:

$$\frac{1\times100}{90}=1.111$$

Or for 100 liquid asphalt, 333 Trinidad.

Such mixture contains of non-bituminous material

In 100 liquid asphalt	10
In 333 Trinidad asphalt	140
In 433 Total	150

=34 6%
and 65.4% bitumen.

For an asphalt paving mixture, if it be now prescribed that it contain 11 per cent. bitumen, how much mixture can be prepared from one ton of the above cement?

$$\frac{2000\times65.4}{11}=11{,}900 \text{ lbs.}$$

This means that for one ton of cement we add 9,900 pounds of sand and limestone or

1900 lbs. limestone.
8000 lbs., or four tons, of sand.

While this is theoretically correct, in practice certain allowances must be made, due to changes in the material, while the cement is mixed with the other materials at a comparatively high temperature. Inasmuch as the mixing methods differ, a factory coefficient has to be established. Whether the body of the asphalt is produced by asphaltogen or asphaltene must also be considered, as also the nature of the petrolenes, inasmuch as the physical properties of the mixture depend naturally upon the physical properties of all the constituents. The determination of the nature of the petrolenes and their proper consideration in the preparation of standard mixtures will be the subject of another communication.

I have indicated above that asphaltene, as well as asphaltogen, when heated in air, absorb oxygen from the air. This oxygen is partly used for the removal of hydrogen, with which the oxygen forms water,

which escapes; but another portion of it combines with the residuum and stays in such combinations.

The substance finally formed I have called asphaltic oxide or acid. It is absolutely inert against solvents, and inasmuch as we call those organic substances which practically do not dissolve in chloroform or any of the substances found in asphalt non-bituminous, it is considered as of no value. Its formation must, therefore, be prevented as much as possible.

The conditions for the prevention of its formation are not too high temperature and exclusion of air. Air stirring in the manufacture of asphalt cement should never be resorted to.

Petrolenes are also apt to be lost by volatilization. The high temperature is, however, in other ways often the cause of transformations.

The reckless use of high temperature is, according to my observations, the cause of charging the bituminous portion of asphalt with sulphur.

Nearly all asphalts, like other carboniferous minerals, contain iron pyrites.

If we extract the bitumen from the crude or carefully refined asphalt, we often obtain preparations which contain hardly any sulphur, but if the asphalt is first recklessly refined, we obtain a bitumen rich in sulphur. In one case the quantities of sulphur in crude bitumen to refined bitumen ranged as 1:10. Whether and how far this is to be looked upon as a deterioration must be left to further investigation.

It will be seen from the facts stated that municipalities will be enabled to provide better safeguards in their specifications for paving contracts than they formerly could when a rational method of asphalt analysis did not exist. They can demand a certain composition of pavement, which the contractor has the means to comply with.

ANSWER BY MR. CLIFFORD RICHARDSON, CHEMIST.

The above article by Mr. Endemann, having been shown Mr. Clifford Richardson, he answers that he "first employed the terms petrolene and asphaltene to distinguish the portions of the bitumen of Trinidad asphalt soluble in petroleum naphtha and carbon di-sulphide respectively in the sixth annual report of the inspector of asphalt and cements of the engineer department of the District of Columbia, 1892. I adopted the names from Boussingault for convenience, but made no claim that the substances separated by solvents were identical with those obtained by volatilization. They were similar enough to make the use of the empirical names convenient and proper. At present, because of the various ways in which these names are defined by different chemists, it seems best to abandon their use entirely and to substitute the designations naphtha soluble bitumen and subsequently carbon di-sulphide soluble bitumen in places of the misused and uncertain terms petrolene and asphaltene. There will then be no misunderstanding."

THE SEWAGE DISPOSAL PLANT AT ALTOONA, PA.

*By Harvey Linton, City Engineer of Altoona.**

The rapid growth of large centers of population and the maintenance of sanitary appliances for their exclusive benefit have not always improved the conditions of rural life in their immediate neighborhood. The mountain stream no longer attracts the angler. The air has lost its sweetness, the river is polluted, and the one time pleasant home by running waters has to be abandoned. Nor does the city escape the evil it has forced upon its neighbors. The farmer's herd that drinks from the poisoned stream furnish to the city families their daily supply of milk; and thus may be traced the frequent cause of serious epidemics. On the sea coast the problem of what to do with sewage is comparatively simple, although there is a limit to the use of harbors as disposal plants. On lakes and rivers, which usually are sources of water supply, the necessity for some improvement in primitive methods is growing more and more apparent. In cities and towns, upon small water-courses, this subject is one that compels attention at an early period. Such a city is Altoona, at the base of the Alleghany mountains, near the sources of the Juniata river, its elevation being between 1,110 and 1,335 feet above sea level.

The larger part of the city is drained into a small stream which flows northeastward. A little less than half the city, for which the sewage disposal plant is now being constructed, is drained southward toward Hollidaysburg. These streams, uniting at Petersburg, 27½ miles east of Altoona, form the Juniata river. The latter sewer district has a population of about 15,000, with an additional suburban population of 3,000. The area of the water-shed drained by the fourth district sewer is about 2½ square miles; that part of this water-shed which lies within the city limits, and for which the plant to be described is constructed, has an area of about 1⅓ square miles. The sewers not being large enough to carry off all the storm-water from this large area of water-shed, are sometimes overflowed and the low ground in the city is submerged.

At Mill run the drainage area is about eleven square miles. At Sugar run, three miles from the city, where the outfall sewer ends, it is ten square miles, or 2.1 square miles per thousand of population connected with the sewer, or only 1.5 square miles per thousand of population to be considered in providing for sewage disposal. Three and one-half miles below Sugar run, as the water flows, is the county seat of Blair county, Hollidaysburg, with a population of 3,150. The fall of the stream is about forty feet to the mile. Opposite to the town the stream has a much less rapid fall and there is a dam which makes slack-water for a considerable distance. Here the drainage area is seventy-five square miles.

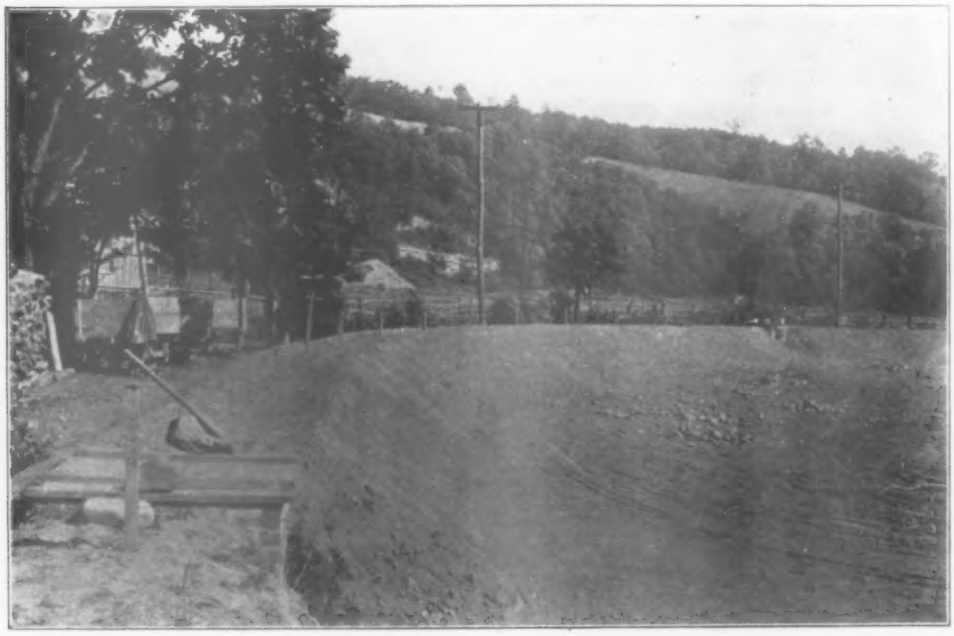
A comparison between the records of rainfall in Altoona by Dr. Charles B. Dudley, chemist P. R. R. Co., and those made by the Altoona water department, at Kittan-

* Abstract from paper read before the Engineers' Club, Philadelphia, May 25, 1897.

ning point, five miles distant, and about three hundred feet in elevation above the rain-gauge in the city, shows that, in 1895, the rainfall at Kittanning point was forty-nine per cent. greater than in Altoona, and in 1896 it was twenty-three per cent. greater. These results are shown in the tabular statement appended. Measurements of stream flow at Kittanning point are also shown in similar table.

practically nothing in the dry season between Altoona and Mill run. Then to Sugar run the stream at times of low water is too small to afford sufficient dilution to prevent its becoming a nuisance.

Suits were brought against the city in 1882 and in 1889 for the pollution of springs about two and one-eighth miles southward from the city limit. The city paid in damages and costs, on this account, $9,367.81. The location of these



FILTER BED OF THE SEWAGE DISPOSAL PLANT AT ALTOONA, PA., LOOKING SOUTHWARD FROM GATE CHAMBER NO. 5, SECTION A.

Weir measurements of Mill run and Sugar creek at their junction at the outfall sewer, also of the sewage flow at the outfall of the fourth district sewer, were made during the drought of 1895, and the results are shown in the accompanying statments. These figures are of interest as affording means of estimating the amount of dilution of sewage at different points and at different seasons. This is

springs is shown on the accompanying map. It is possible that the sewage-polluted waters of Mill run may flow through underground channels in the limestone to these springs. But this fact has not been very clearly demonstrated.

Nothing was done toward improving old sewage-disposal methods by the city until early in 1895. It was then determined to take action, and to be guided by expert

advice. Mr. Rudolph Hering, the well-known sanitary engineer of New York, was accordingly asked to study the situation in Altoona and to devise a method suited to the city's needs.

Mr. Hering, in his report to city councils, February 7, 1895, said: "Whatever may be the future mode of disposal, the sewage will first have to be carried further down the valleys. This part of the work is advised at present." It was then supposed that the dilution of the sewage at Sugar run by the other streams coming in below would prevent any complaint until a larger growth of the city would make sewage treatment necessary. The people of Hollidaysburg, however, took another view of the matter, and the prospect of further damage suits made it advisable to proceed at once to make a final and satisfactory disposition of the city's sewage. In his report, Mr. Hering said further: "The best means of purifying sewage is by filtration through sand, soil or artificially-prepared materials. Natural filtration through sand is to be preferred in every case, where sufficient territory can be secured for the purpose, at a fair price. The sewage must be applied intermittently so as to allow sufficient time and opportunity for an oxidation of the organic matter to take place in the interstices of the sand." Different methods of sewage treatment were described, and the subject fully discussed in the report. Mr. Hering went over the ground in 1888, and at that time suggested such a sewer as is now constructed to Sugar run. The writer, acting on this suggestion, made a survey and an estimate of cost of this work in March, 1889. In November, 1895, after the construction of this sewer was begun, the people of Hollidaysburg, who objected to Altoona's sewage, discharged three miles nearer to their town, made complaint before the court. An injunction was soon granted, which still restrains the city from making any use of the sewer until after the completion and successful operation of the filter-beds which are now being constructed.

This sewer was completed in August, 1896, at a cost of $42,912.49. It is constructed of 27-inch vitrified sewer pipe from the city limit to the electric railway in Llyswen, a distance of 6,095 feet, thence for 3,183 feet to a point 1,520 feet below Llyswen it is of 30-inch sewer pipe, and thence to the end, 5,773 feet, it is constructed of concrete and brick. The invert is of vitrified paving brick. The form of the sewer is oval, 33¼ inches by 94 inches. The intake is at the end of the fourth district sewer, and the outfall is built between Mill run and Sugar run, at their junction, nearly three miles from the city line. Thirty-six man-holes, thirty-four with perforated iron covers, are constructed on the system between the city and the filter-beds. In Llyswen the man-holes are built near the center of the street intersections. It is intended that local sewers shall connect at these man-holes if the city councils of Altoona will grant permission for such use of the main sewer.

At Sugar run, a special man-hole, with weir and sluice-gates, will direct the flow of the sewage that is to be treated through 1,440 feet of 18-inch pipe sewer and 200 feet of cast-iron pipe (the latter forming an inverted siphon, which is laid under the bed of the stream to the screen tank at the upper end of the beds. The screen tank contains a screen eight feet long, made of 95

iron bars ¼ x 2 x 45-inches, set at an angle of 72° from the horizontal, edgewise to the flow, one inch apart from center to center. The lower ends of these bars are imbedded in the concrete bottom. A wooden grating makes a platform three feet above the bottom, upon which the refuse, raked from the grate, may drain before it is thrown out to be burned or otherwise disposed of. Iron gates of simple form will direct the flow and divert the sewage from thirty-four gate chambers into thirty-six separate sewage beds, sewage carriers, of vitrified sewer pipe, 15 to 10 inches in diameter, being constructed in the outside embankment, and each bed having a 10-inch supply pipe.

Four additional beds will be supplied from one gate chamber outlet. A 10-inch iron siphon under the stream connects section "A" of the beds with section "C," which adjoins the Hollidaysburg branch railroad.

Before deciding upon filtration a number of test pits were dug upon the site of the proposed filter beds to the ground water level, which was from six to nine feet below the surface of the ground, and samples of the soil were taken from these pits by Mr. Allen Hazen for analysis. Mr. Hazen's report of Nov. 2, 1895, says: "The material of this land is made up of two distinct layers; the upper layer is from one to five feet in depth in different parts of the field, and consists of fine, sandy soil or loam, with fine sand below. The upper part or soil differs from the lower part of the layer only in containing more organic matter, and the difference is not great enough to warrant any subdivision of the materials in handling it. The material allows water to percolate through it somewhat freely, but it contains a considerable amount of iron and alumina, as is shown in the chemical analysis, and these and other gelatinous materials allow it to be compacted more closely than pure sand, and to cake together into a solid mass upon drying, after having been wet. The second kind of material underlies the upper layer and is much more open in its texture, and consists of particles ranging all the way from moderately fine sand to bowlders a foot in diameter."

A diagram showing the percentage by weight of different diameters of grains of these filtering materials has been prepared by Mr. Hazen, and a blue-print copy of it is added to this paper.

These filter-beds must provide for about 750,000 gallons per day at present, estimating fifty gallons per capita daily from a population of 15,000. This does not include rainwater or ground water. The city paid $12,000 for the tract of ninety-six acres, of which nearly seventy acres are available to be graded for sewage-beds.

The first step in the preparation of these beds was the laying of a system of under-drains composed of nearly six miles of agricultural drain-tiles and sewer pipe. The tile drains are from three to six inches in diameter, and the sewer-pipe from eight to fifteen inches. The drains are from four to six feet below the level of beds. They discharge at the surface of the stream through cast-iron pipes. The grading of the sewage-beds will require the removal of about 58,000 cubic yards of material, each bed furnishing the material to fill up its depressions to a level surface and to make its surrounding embankments.

In the operation of this system of sewage disposal, there will at all times be a flow of sewage from the Fourth district sewer through the

outfall sewer to Sugar run. The amount of this flow, together with a part of the storm-water flow, will be at times more than seventeen million gallons daily. This will assure the good condition of the waters of Mill run at all seasons, any excess of stream flow being composed of so large a proportion of ordinary surface drainage as to make the amount of sewage to be found in it inappreciable.

When the streams are lowest, in the dry season, all of the flow of the sewage from the city will be treated on the sewage-beds. At other times the excess will overflow the river at Sugar run. When this occurs it will be at times when the streams are swollen by rains, and the amount of sewage, in proportion to the volume of water from the forty square miles of water-shed that is drained by Sugar run and Mill run, will be so small as to cause no nuisance.

From the screen-tank the sewage will be diverted to any bed or series of beds, as required. Each bed, after having been overflowed, will have sufficient time for the percolation of the sewage through the soil and to allow the air to enter the interstices between the sand-grains before the next overflowing. This process insures a thorough purification of sewage.

A sample of two gallons of the effluent from the experimental filter at Lawrence, Mass., which was sewage that had been filtered at the rate of 20,000 gallons per acre per day, was exhibited to the court at Hollidaysburg on January 3, 1896. This sample was tasteless and odorless and in appearance like the purest spring water. Many persons at that time and afterward tasted of this sample of purified sewage, and acknowledged that they could not distinguish it from the best spring water. In December, 1893, the writer visited a number of sewage-disposal plants in Massachusetts. At that time the effluent from the filter-beds at Framingham and Brocton was, apparently, perfectly pure water.

Properly designed plants, on the principle of the intermittent filtration of sewage through sandy soil, can be used to advantage by even small communities wherever the conditions are favorable to their construction.

The universal adoption of efficient means of sewage purification would transform noisome neighborhoods of cities, where now only those who must be content with the poorest sanitary surroundings find homes, into the most attractive of suburbs. Streams would be restored to almost their original purity, children find pleasant playgrounds along their shaded banks, and malaria and the dump-heap be associated with them no more.

Rainfall in 1895 and 1896. From Records of.			Stream-flow at Kittanning Point, from Weir measurements, below 55,000 000 gallon reservoir, supplying Altoona about 6,000,000 gallons daily. (9.3 sq. m. water-shed.)	
	Dr. Chas. B. Dudley, Altoona, Pa.	Water Dep't at Kittanning.		
	Inch.	Inches.	Gallons per 24 hours.	
Jan., 1895.	3.22	3.758	Dec., 1894.	270,927,500
Feb., "	0.17	0.613	Jan., 1895.	341,908,000
Mar., "	1.05	1.836	Feb., "	65,599,000
April, "	2.16	3.666	Mar., "	662,386,000
May, "	0.80	1.713	April, "	836,541,500
June, "	3.75	5.178	May, "	98,397,500
July, "	1.75	3.144	June, "	14,951,000
Aug., "	1.64	2.982	July, "	12,279,500
Sept., "	2.28	2.854	Aug., "	.....
Oct., "	0.55	1.318	Sept., "	.....
Nov., "	1.30	1.320	Oct., "	.....
Dec., "	2.50	3.202	Nov., "	.....
	21.17	31.584	Dec., "	19,510,500
				2,046,573,500
Jan., 1896.	0.87	0.750	Jan., 1896.	26,008,000
Feb., "	1.94	1.238	Feb., "	388,844,000
Mar., "	1.77	1.681	Mar., "	482,732,500
April, "	1.38	2.057		
May, "	2.70	3.974		
June, "	7.69	8.079		
July, "	4.22	5.958		
Aug., "	1.70	2.524		
Sept., "	6.03	7.098		
Oct., "	1.66	2.630		
Nov., "	2.59	3.323		
Dec., "	0.89	1.722		
	33.44	41.034		

Weir measurements of flow of sewage at the fourth district sewer outfall, in October, 1895.

From September 28 to December 20, 1895 (84 days), the water supply of Altoona, Pa., was cut off, except between the hours of 4 and 8 P. M.

			Cu. ft. per second.
Oct. 4, 1896.	527,350 gallons per 24 hours.		0.816
" 5, "	426,539 "	"	0.660
" 7, "	380,008 "	"	0.588
" 8, "	426,539 "	"	0.660
" 9, "	478,888 "	"	0.798

Cut off—

Oct. 10, 1896.	143,472 "	"	0.222
" 11, "	559,240 "	"	0.865
" 12, "	527,350 "	"	0.816

Dry weather flow of Sugar run and of Mill run, at end of outfall sewer, in 1895.

Nov. 8.	621,930 gals. per 24 hours,	Sugar run,	0.96
Nov. 11.	728,957 gals. per 24 hours,	Mill run,	1.12
Total,	1,350,887		2.08

REVIEW OF METHODS OF CEMENT TESTING.

The following table brings into one view the answers to questions regarding cement testing, which appeared in the April, May and June numbers of MUNICIPAL ENGINEERING. The statements are greatly condensed, and reference should be made to the full statements. The questions precede the table. They have been subdivided as indicated for convenience in forming the table. Some comments on the answers follow. Since the matter has been taken up by the American Society of Civil Engineers, every one is interested in the report.

It would be much better for each one who feels that he has some point of value, to present it for discussion as soon as possible, that the committee may gather from the discussion the valuable portions. These questions were formulated before the American society decided to appoint the committee, but they are an excellent basis for a discussion which will be of special value at this time. The columns of MUNICIPAL ENGINEERING are open for this discussion.

Test for Fineness—Sieves.

1. What size of mesh should be used in testing fineness? I, Portland. II, Natural cement.
   a. First choice.
   b. Second choice.

Weight Per Cubic Foot.

2. (*a*) Is the weight per cubic foot of sufficient value to be retained, and if so, (*b*) what method should be employed?

Specific Gravity.

3. Do you consider the test for specific gravity of value, I, for Portland; II, for natural cement:
   I*a*. For an unknown cement.
   I*b*. To test uniformity of an accepted brand.
4. What form of apparatus do you prefer for this test?

Chemical Analysis.

5. Under what conditions do you consider a chemical analysis essential?
   a. Complete analyses.
   b. Partial analyses.

Time of Setting.

6. What do you consider the best method of determining the consistency of mortars for this test?
7. Should the time of setting be determined for mortars containing sand as well as for neat cement mortars?
8. What method do you prefer for this test, and what special conditions are desirable in its execution?
   a. First choice.
   b. Second choice.
   c. Conditions.

Soundness.

9. What in your opinion constitutes a practical and sufficient test for soundness, (I) of Portland, (II) of natural cement?
   a. Cold test.
   b. Hot test.

Tests of Strength.

10. What do you consider the most valuable strength test that is practicable to execute under ordinary conditions?
    I. For Portland cement.
    II. For natural cement.
       a. For single test.
       b. For complete series.
       c. During progress of work.
11. Do you consider that the form of mold recommended by the American Society of Civil Engineers committee in 1885 for tensile tests, and now in general use in this country, (*a*), can be improved, and if so, (*b*), in what direction should modification be made?
12. How may the consistency of the mortar be defined and determined so that

COMPARISON OF ANSWERS BY CEMENT EXPERTS TO QUESTIONS SUBMITTED BY MUNICIPAL ENGINEERING MAGAZINE.

	B. L. Green.	L. Treadwell.	J. Sondericker	F. P. Spalding.	J. W. Woermann.	S. B. Russell.	A. S. Cooper.	G. Bouscaren.	H. W. Parkhurst.	A. Lundteigen.
1 I a.	100	100	.....	100	100	100	120	100, 74, 50, 100 alone to prepare briquetts for testing.	100 or more.	100 or more, dispense with 50.
1 I b.	74 or 80	.....	.....	.....	.....	.....	.....	.....	.....	.....
1 II a.	100	50	.....	100	100	100	80	.....	.....	.....
1 II b.	74 or 80	.....	.....	.....	.....	.....	.....	.....	.....	.....
2a.	No.	Secondary.	.....	Little value.	Unnecessary.	Comp. value.	No.	Not necessary.	Not practicable.	No.
2 b.	.....	Only for exp't.	.....	.....	.....	Close packed.	.....	.....	.....	Same value as indicating degree and uniformity of burning.
3 I a.	No.	Only for expert in special cases.	.....	May help.	Prefers heaviest.	Omit in standard specification.	No.	Not necessary.	Ditto.	
3 I b.	Some less than for Portland.		.....	May help.	Unimportant.			.....	.....	
3 II.	.....	.....	.....	Unnecessary.	.....	.....	.....	.....	.....	
4.	Several. E. J. Seger.	No preference.	.....	1. Le Chatelier. 2. Schumann.	No special form.	.....	.....	.....	.....	Schumann's as improved by Suchier
5 a. b.	From time to time.	Only on suspicion of adulteration.	.....	Unnecessary except to judge material and for sea-water use.	None.	All for Portland.	Only where expansion would be dangerous.	Where excess of sulphate of lime is suspected.	Any complete examination.	Only in sea-water work.
6.	Direct experiment.	Am. Soc. C. E.	.....	Tetmajer's with Vicat needle.	Experiment.	Unreliable for record.	Temp. produced by setting.	Same as for tensile test.	We do not know much about this yet.	German method.
7.	Not necessary.	Yes.	.....	Neat, more reliable, sand sometimes desirable.	Not necessary.	No.	No.	Yes.		Penetration of rod at 60° to 65° temperature.
8 a. 8 b. 8 c.	Vicat's needle. Gilmore's Uniform.	See page 227, April number.	.....	Neat, 1 Vicat, 2 Gilmore; sand, 1 Gilmore, 2 Vicat.	Vicat needles.	.....	.....	Gilmore's needle test temperature 60° to 70°.		No. Gilmore.
1 a.	Pat in air 24 hrs., water 28 days.	Am. Soc. C. E.	.....	Pats under normal conditions preferred.	Pats acc. to Am. Soc. C. E.	Pats acc. to Am. Soc. C. E.	.....	After setting put in water at 160° to 180°.	Nothing new to offer.	28 day pat in moist air 24 hrs and water after. 2d choice Erd.
9 I b.	Pat in 120°, air 6 hrs., water 24 hours.	Only for expert.	.....	Perhaps more certain.	.....	Briquettes determination of magnesia.	.....			
9 II.	.....	.....	.....	.....	.....	.....	.....	.....	.....	Menger's hot test.
10 I a.	Tensile, 3 sand, 1 cement, 28 days.	Am. Soc. C. E. Can be improved in minor details.	Compression. See page 228, April number.	Tensile.	Tensile or cross-breaking, crush ing sometimes.	Tensile, 24 hours air, 6 days water. Neat.	Compression the only proper one.	Tensile test for convenience, compression test most desirable.	Tensile most valuable.	Tensile or compression on 28-day briquettes.
11 a. 11 b.	No.	Suggest making briquette ½ in. longer.	Yes, see page 76, February number.	.....	Undecided.	Doubt if it can.	No.	Prefers short length of uniform section.	Yes, has obtain'd good results with other form.	Yes, German form best.
12.	Detailed descriptions of methods	Suggests table of % water recommended by each mfr.	.....	Ball to fall without cracking.	Water for cement by trial. Water for sand 7 %.	Mechanical mixer and defining amount of work done.	By penetration of rod or bringing water to surface by blows.	Same percentage in weight of water.	Personal equation prevents definition.	See p. 352, June number.
13.	Hand trowel on glass.	Hand trowel Machine not satisfactory.	.....	Mechanical mixer, E. G. Faija's.	Hand trowel 2 m quick, 5 m. slow, setting cement.	Jig run by power.	Mix sand cement by machinery and work in water by hand with trowel.	Rapid and mechanical mixing 3 minutes.	Machine.	Trowel on glass or metal 3 min.
14 a. 14 b.	Bohme hammer. Handle with great care.	Very careful hand. Machine not satisfactory.	Neat cement any method removing air Sand mixture, uniform method.	Hammer or definite direct pressure, hand, stiff mortar, pressed into mold.	Boehme hammer, Russell's lever.	Most mechanical e. g. repressed briquettes.	German hammer.	Fill molds mechanically and use constant finishing pressure.	Doubts machine	Press into molds with ¾-in. stick and level off with trowel, no pounding.
15.	Keep in moist air 24 hours constant temperature. Keep water clean and fresh.	In mold till set. Moist air.	.....	Damp on non-porous surface at uniform temperature.	In wet cloth 24 hours, then on edge in water removed twice a week, uniform temperature.	In molds till hard enough to take record moist air at 78° 24 hours, then water at 70°.	Moist air till set, temp. 70° to 80°, then in water of same temperature changed frequently.	1 hr. or 1 day in air on glass under wet cloth at 60° to 70°, then soft water same temperature.	Keep under damp cloth and not handled till set.	In molds till set, then flat side down on glass covered with wet cloths for 24 hrs. then on end in water.
16.	Any accepted form. Prefer German for uniformity of apparatus.	.....	See J. A. E. S. Jan., 1888, for form.	Rubber bearing surface, small area of contact.	One with pivots to prevent bending strains.	St. Louis form articulated clip with parallel motion.	Reible Bros. roller clips.	Am. Soc. C. E. Clip with swivel joint.	.....	No form which will always break briquettes on smallest section.

Mr. Green alone answers 10 I a, 10 b and 10 c as follows: 10 I a, 1 sand, 1 cement, 28 days; 10 b, neat, 7 days, 28 days, 3 mos.; with sand, 7 days, 28 days, 3 mos.; 10 c, neat, 7 days, with sand, 7 days.

different laboratories may employ mortars of the same consistency?

13. What do you consider the best method of mixing mortar for tensile or other tests?

14. What method of filling the molds and finishing the specimens will give most nearly uniform results?

First choice.

Second choice.

15. What special precautions should be taken with the briquettes from the time of molding until they are ready to break?

16. What form of clip do you prefer for breaking briquettes in tension?

1. It is interesting to note the increase in the fineness of the cement which is required. All the experts now prefer a sieve of 10,000 meshes to the square inch or more for Portland cement, and all but one drop the 2,500 mesh sieve, even for natural cements. It is but a short time since the specifications of the committee of the American Society of Civil Engineers, using No. 100, No. 74 and No. 50 sieves, were accepted everywhere as the standard. The new processes of manufacture, making fine grinding easier, and the growing conviction that the coarse particles in a cement act simply as sand, have led to the change in the demand regarding fineness. Sieves as fine as No. 200 are not unheard of, and if the new committee of the American Society of Civil Engineers pays attention to the signs of the times, it will take finer sieves than No. 100 into careful consideration, in determining this item of the new specifications.

2. All agree that the weight per cubic foot is not important, can be well determined only by an expert, and its consideration may be omitted from the ordinary specification.

3. The test for specific gravity in ordinary cases is not considered advisable, but some would give it place in complete expert examinations. Few give it the importance it deserves when the questions of degree and uniformity of burning of a cement are to be discussed.

4. No apparatus for determining specific gravity has more than one vote. This may be because no one has considered the determination of sufficient importance to spend time in comparing methods, and gives the one he has been accustomed to use. If any one has used the various forms of apparatus enough to be competent to form a judgment, he should give the results of his experience for the benefit of his fellow-workers.

5. Two consider chemical analyses of value in a complete examination of a cement. Probably all do, but, confining their remarks to the ordinary working specification with accepted brands, are satisfied in such cases to call for chemical analyses only on suspicion of adulteration, where the cement is to be used in sea water, or where expansion would be dangerous.

6. The best methods of determining the consistency of mortars are various. Mr. Cooper's, regarding the determination of the rise in temperature during the process of setting, is worthy of consideration. Our information on this line is not sufficient to give a definite idea of the connection between rapidity of setting and hardening and change in temperature of sample on account of chemical action. Answers to this question are not well differentiated by some from answers to those following.

7. But two or three consider the determination of the time of setting of sand mixtures desirable.

8. Vicat's needles seem to have the preference, with Gillmore's next. Gillmore's are preferred by Mr. Spaulding for sand mixtures and Vicat's for neat cement. Evidently most of the experts consider the time of setting of sand mixtures

'as determinable from the neat tests with sufficient accuracy. This would assume that the variation in time of setting is variable directly with the amount of sand, and that if one neat cement sets quicker than another its sand mixtures will also set quicker than the corresponding sand mixtures of the other.

9. It is interesting to note the slight stress that is now put on the hot test for soundness. Only one gives this test at a temperature of 160° to 180°, one gives it at 120°, one gives Erdmenger's hot test as a second choice, and one thinks the hot test is perhaps more certain than that at ordinary temperatures. The others are silent as to a hot test.

10. The influence of the discussions of the compression test is seen in the replies to this question. This is another item concerning which the committee of the American Society of Civil Engineers must consider the tendencies of the times if it is to make a specification which will be of value for the future. Mr. Green gives the only attempt at a full statement of the tensile tests best suited for insertion in a specification. His list is suitable for the preliminary tests of a brand of cement, but will not always be applicable on the work after the brands are selected, and the shipments must be tested for comparison with the original samples. The tendency towards testing briquettes of seven to twenty-eight days age is marked, and shows the results of combined experience. Mr. Green's testing of sand mixtures only, for Portland cements, also indicates careful comparison of the tests with each other and with the cement in actual use.

11. Two think the form of the American Society of Civil Engineers' briquette can not be improved, one doubts if it can, one is undecided, one does not answer, the rest think it can be improved, one proposing to lengthen the briquette, two to shorten the length of uniform section, and one changing the general form.

12. The definition of the consistency of mortar for testing seems to be difficult. More propose a definite percentage of water than any other, one proposing that this percentage be fixed by the maker of the cement, and that tables be furnished experimenters giving the various percentages. This would help towards uniformity. The personal equation certainly enters into the manipulation of the briquettes, but a uniform percentage of water for each brand of cement would remove one very fertile source of variations. Different cements do require different amounts of water, and whether the amount of work on the briquette or the amount of water is varied, there is a chance for variation in conditions unless a table of requirements of the various cements is kept at hand for reference. In a large laboratory this table would be made for that laboratory, but in the ordinary municipal laboratory there is hardly time for the necessary experiments.

13. Four would mix the mortar for making briquettes by machine, four by hand, and one would mix the sand and cement by machine and work in the water by hand; one does not answer. Where the experts are so evenly divided, it is not likely that the ordinary small laboratory will go to much trouble or expense to set up a machine for mixing, when there is so much authority for the belief that good hand mixing is as satisfactory in its results as machine work.

14. Four would use the hammer

for forcing mortar into molds, one would do the work carefully by hand, one would use the hammer or direct pressure, one would use the most nearly mechanical method, one would press into molds with stick and level off with trowel, one doubts the efficacy of machine methods, and one would use any method that would remove air. The hammer, therefore, has the preponderance of recommendation. In all cases a definite weight let fall through a definite distance a definite number of times is preferred.

15. All require the briquettes to remain in moist air or under a damp cloth, until ready to put in water. The water is generally required to be clean and fresh, and kept so, either by constant or periodical changes. Constancy of temperature is also recommended.

16. No form of clip seems to fulfill the desire for one that will permit the briquette to break always at the smallest cross-section. Roller clips, swivel, pivot or articulated joints, rubber bearings, are all approaches to the desired form, but none is yet found which is entirely satisfactory. Both form of briquette and structure of clips have their influence on the location of the break. Further experiment is necessary to determine the proper combination.

ANNUAL MEETING OF THE AMERICAN WATER-WORKS ASSOCIATION.

The seventeenth annual convention of the American Water-Works Association at Denver, June 8, 9 and 10, was a pleasurable occasion for those in attendance. Denver is an attractive point, especially to those who have never visited it, because it is an outpost of civilization, representing in a pretentious way the varied elements of western life at the point where vast plains and awe-inspiring mountains meet at a great altitude. People who can afford the time and money are quite willing to travel two or three thousand miles for the novel experience of sweltering in Denver on a June day while they look out on snow-covered mountains in the distance, and, if they like, go up where snow and sunshine shift on the scene so quickly that one can not foretell with certainty what an hour of time will bring forth. And then it is something to breathe that strange air which seemed almost intoxicating when referred to by the governor of Colorado, in addressing the convention, as "champagne air."

These attractions and others were sufficient to bring nearly a hundred people across the plains to attend the Denver convention, and it was to be expected that they would receive a large share of the attention due the serious business of the meeting. The arrival of the party in Denver and a trip over the city a day in advance of the opening session did not prevent this interference altogether. Meritorious papers on important subjects were not discussed with the usual interest and profit, although opportunity for previous consideration was given by placing printed copies in the hands of those present in advance of arrival at Denver. The local arrangements for the meeting, under the direction of Chairman C. P. Allen, were well looked after, and the hospitality of Denver was

shown amply and most cordially. An enjoyable feature of the entertainment was a day's trip up the Platte river, from which the water supply of Denver is obtained, and an inspection of the water-works. The programme for the convention showed many papers, and President Pains was prompt in calling the sessions to order, and the business was expeditiously disposed of. The opening session was occupied largely with welcoming addresses by Governor Adams, Mayor McMurray, and Chancellor McDowell, of the University of Denver, to which President Davis responded on behalf of the association. In his annual address to the convention President Davis said:

The correspondence during the year has shown that the officers of water-works, whether owned by corporation or by the public, have been much annoyed and vexed by the attacks of the newspapers on their rates and charges. The only reply to these attacks that could be made was to suggest an examination of the rates of different cities and their general tax, though at the same time it must be remembered that no city can be governed entirely by the rates prevailing in other cities, for the receipts, expense account, repairs, extensions and physical conditions of each individual city will have to be a guide in fixing rates.

Examination made during the year convinced me that many cities showing a low water rate have a heavy rate of taxation. Some have as high as $31 on the $1,000 for a general tax. In comparing rates the general tax, tax for mains and the method of assessing, as well as the rates themselves, must be taken into consideration.

There has been some consultation in regard to buying and selling plants. I have been asked to suggest an equitable basis for selling. I have replied that no rule could be laid down that would be applicable to every plant because of the varying conditions, but a sum upon which the net earnings would pay the lawful rate of interest would be a fair price for the property, although attention must be paid to the condition of the plant. It is the custom to appoint appraisers, but the men knowing the most about the works are not appointed. Although the appraisers may be very competent and well posted, yet it is not possible for them to know everything that has been wrought into the work of building and maintaining the plant unless identified with it. The civil and hydraulic engineering expenses, the education of the people to take water, things which are not tangible, yet which form no small part of the expense of the construction of the water-works plant and the production of a revenue, are not taken into consideration.

During the year there has been some progress in mechanical filtration and some modification of plans for sand filtration. There is now being conducted an experiment with iron as a substitute for alum. Some cities of importance are endeavoring to obtain a supply from deep well pumps; others are using compressed air as a means of lifting the water from the wells.

Whether a great quantity of water is available remains to be demonstrated.

Public interest in filtration is steadily increasing. The people are hoping that before a great while water of a high degree of purity will be provided for them in great abundance, for it means less doctor bills, good health and a lower death rate. It is therefore incumbent upon the members of the association to avail themselves of all possible information pertaining to the question of obtaining a pure and wholesome supply for their respective cities.

Stream pollution has had much attention during the year in some of the states, and stringent laws have been enacted. Yet it will be necessary for the general government to pass laws governing the pollution of streams flowing through different states. Not only will it be necessary for the health and life of the citizens, but for the vast grazing industry and the preservation of the fish, which afford food and recreation for the people.

Bacteriology, no longer a theory, but an established scientific fact, is steadily making progress in the world of things beyond natural sight. Much knowledge of the hidden wonders of life, beneficial to human beings, is being obtained. While this is true, yet, for lack of experience, much mischief is done. The multiplicity of bacteria and the reaction of different species are so alike that an actual determination of the bacteria is almost impossible. In fact, the real typhoid fever bacteria can not be definitely determined at all times until an inoculation of an animal is made and the results demonstrated that it is typhoid fever bacteria. Very often death returns are made by physicians for typhoid fever when in fact the result of death was from other causes. Notwithstanding the indefiniteness mentioned, great good has been produced by the study of bacteriology, and it is essential now, in addition to the chemical analysis of water, to have a bacteriological examination made at the same time.

Applications for membership in the association were approved as

follows: Active, William P. Robinson, Denver; William F. Allen, Denver; Henry A. Cook, Salem; W. R. Hill, Syracuse; Ezra L. Emery, Rock Springs, Wyo.; Kenneth Torrance, Cleveland; Morris R. Sherard, Newark; Walter C. Brough, Erie, Pa.; Fred J. Gubelman, New York; Horace Kingman, Brockton, Mass.; W. B. Cunningham, Trinidad, Colo.; Lee Riley, Kansas City. Associate—Bethlehem Iron Works, South Bethlehem, Pa.; P. V. Dwyer, St. Paul; W. M. Deutsch, New York.

The president reported the death of seven members during the year. A special committee was appointed to prepare memorial resolutions.

The secretary's report showed that the receipts for the year had been $2,539.49, and the expenses $1,472.79, leaving a balance of $1,067.30. The salary of the secretary was increased from $800 to $1,500 a year.

L. H. Gardner, New Orleans, asked for information as to the practice in other cities regarding charges for automatic sprinklers. He said that his company had refused connections for such sprinklers on the ground that the company would be held responsible if the sprinklers failed to work, and that when they did work they reduced the pressure and delivering capacity of water for other property equally entitled to the fullest protection that could be given. Several members said that they made no charge for water for the sprinklers, as they tended to lessen the danger of fires and were demanded by insurance companies as a protection. In some cities a charge was made according to the size of the connection and the area of protection. In Denver the charges ranged from $75 to $240 a year.

A voluntary paper was read by F. W. Cappelen, city engineer of Minneapolis, on tests of coatings for steel water pipe. He described his tests and set forth the results. He reported that his tests showed that the mineral rubber asphalt of the Assyrian Asphalt Company "is the best, and, judging from other information at hand, is probably the best coating ever put on the market, not barring the so-called Sabin japanning process." The specifications for the coating of the 50-inch steel pipe in Minneapolis were as follows:

"After testing to the satisfaction of the engineer, the pipe shall be thoroughly dried and cleaned, and heated in suitable oven to 300° F., after which they are to be thoroughly coated by dipping vertically in a bath of mineral rubber asphalt, manufactured by the Assyrian Asphalt Co., at Chicago, Ill., or such other material equally as good as the engineer may designate. (This to protect the city.) This coating must be smooth, hard, yet tough, elastic and durable; it must be free from blisters and bubbles. The bath must be heated in such a manner as to insure a constant and even temperature of 300° F., preferably by steam.

"The dipping material must be kept free from sand, grit or other foreign material. To obtain this the contractor shall, as often as necessary, in the opinion of the engineer, empty the tanks of their contents and refill them with clean and pure material."

A number of the papers prepared for presentation to the association were ordered to be printed in the proceedings without reading, and in several instances persons on the program were not present and sent their papers to be read by others. Among the papers prepared for the meeting, which were either read or ordered to be printed in the proceedings, were the following:

"The Experience of a Skeptic With Reference to Lifting Water from Wells With Air, and Some Little Information in Regard to Pumping Natural Gas," by F. A. W. Davis, of Indianapolis.

"Methods of Laying Small Size Water Mains, Lowering Water Mains and Relief of Violent Fluctuations in the Direct Pressure System at Madison, Wis.," J. B. Heim, Madison, Wis.

"The Effect of Faulty Construction of Water-Works Plants on Fire Departments and Fire Insurance," W. L. Cameron, Galveston, Tex.

"Sewage Disposal," Chas. Francis, C. E., Davenport, Ia.

"Special Contracts in Water-Works Business," D. H. Maury, Jr., Peoria, Ill.

"A Method of Setting Water Meters," Geo. Cotter, Springfield, Ohio.

"The Causes of the Tastes and Odors Affecting the Brooklyn Water Supply in the Summer and Fall of 1896, and the Methods of Prevention," Dr. Albert R. Leeds, Stevens' Institute, Hoboken, N. J.

"How to Increase Revenue, Free Service Pipes and Filtrations," Dow R. Gwinn, Quincy, Ill.

"The Electrolysis of Water Mains and Methods of Investigating," Lewis Searing, Denver, Colo.

"An Experience With a Drilled Well Adjoining Salt Water," J. S. Haring, C. E., Nyack, N. Y.

"Steel Forging for Pumping Engines," H. F. J. Porter, New York.

The excursion up the Platte canon on Wednesday occupied nearly all of the day, but in the evening Prof. Erastus G. Smith, of Beloit, Wis., gave an address in the Chamber of Commerce, which was illustrated with stereopticon views. His subject was "Ancient and Modern Methods of Water Purification."

Abstracts of some of the more important papers follow this outline of proceedings.

The election of officers developed an interesting contest, but it was practically settled before the voting began, on questions of geographical representation. Mr. Dow R. Gwinn, of Quincy, Ill., was strongly supported for the position of secretary, but he very much desired the election of Mr. Caulfield as president, and on this account withdrew from the contest for secretary. The election resulted as follows:

President—John Caulfield, St. Paul, Minn.
Vice-presidents—J. A. Barnes, Wilmington, Del.; second, C. P. Allen, Denver; third, John B. Heim, Madison, Wis.; fourth, R. M. Clayton, Atlanta, Ga.; fifth, Edmund Mather, Harrisburg, Pa.
Secretary-treasurer—Peter Milne, New York.
Finance committee—Dow R. Gwinn, Quincy, Ill.; W. H. Laing, Racine, Wis.; John S. Ward, Buffalo, N. Y.

Mr. Caulfield, the newly-elected president, is secretary of the board of water commissioners of St. Paul. He entered the employ of the water-works company when sixteen years old, and when the works were purchased by the city was elected secretary of the board. He has managed the works strictly on business lines and has performed his duties well, but has not been a willing tool of the politicians, and for this reason efforts are being made by them to depose him. His election as president of the American Water-Works Association is a deserved tribute to his efficiency as a water-works manager.

A committee on transportation and exhibits was appointed, consisting of W. H. Laing, of Racine, Wis., F. J. Bradley, of Chicago, and Anthony P. Smith, of New York.

Buffalo, Dayton and Put-in-Bay were proposed for the next meeting. Buffalo was chosen. The ballot resulted in 53 votes for Buffalo, 17 for Dayton and 12 for Put-in-Bay.

AT THE CONVENTION.

Atlanta—R. M. Clayton and wife, Park Woodward, W. M. Ropp.
Aspen, Col.—Henry G. Koch and wife.
Beloit, Wis.—Prof. E. G. Smith.
Bethlehem, Pa.—Mansel White.
Boston, Mass.—Francis J. Hersey, jr.
Bridgeport, N. J.—Timothy Woodruff.
Brockton, Mass.—J. W. Locke.
Brooklyn, N. Y.—I. H. Decker, Peter Milne, Henry C. Folger, E. J. Snow.
Butte, Mont.—C. H. Hand.
Burlington, Ia.—Charles Hood.
Chicago—O. Jones, Allen T. Prentice, wife and daughter; Mrs. G. H. Muller, Miss Carrie Burke, F. J. Bradley, C. S. Francis, H. E. Keeler and wife, Mrs. O. E. Freund.
Chippewa Falls, Wis.—L. C. Stanley and wife.
Columbus, O.—A. H. McAlpine, John O'Shawghnessy.
Denver—Richard Holme, Charles P. Allen, D. G. Thomas, W. F. Allen, H. W. Cowan.
Dayton, O.—Joseph C. Markle, R. T. McGregor.
Decatur, Ill.—H. Mueller and wife, Adolph Mueller and wife, Miss Ledah Mueller.
Evansville, Ind.—Theo. M. Genpel and wife.
Erie, Pa.—Will Mimrod.
Greeley—Joseph F. Daniels.
Harrisburg, Pa.—Edmund Mather.
Hoboken, N. J.—D. W. French.
Indianapolis—F. A. W. Davis, William Fortune.
Independence, Mo.—R. D. Wirt.
Johnstown, Pa.—Thomas Watkins, Sylvia Watkins.
Kansas City, Mo.—J. F. Anderson, G. B. King, L. Riley.
Lancaster, N. Y.—E. F. Fraisley.
Lockport, N. Y.—Frank W. Holly.
Leadville—C. N. Preddy.
Marshalltown, Ia.—Charles Glick, Geo. R. Estabrook.
Madison, Wis.—John B. Heim.
Memphis—A. A. Tucker.
Merrill, Wis.—M. F. Wright.
Minneapolis—F. T. Moody, wife and daughter, Col. Sam E. Adams, F. W. Cappelen.
Montgomery, Ala.—Fred Crosby, W. J. Taylor.
Newark, N. J.—J. L. Wertz, M. R. Sherrerd.
New Orleans—L. H. Gardner
New York—Jonn C. Kelly, F. W. Shepperd, William Deutsch, Fred A. Smith, Geo. H Clingman.
Omaha—Charles G. Scott and wife.
Pekin, Ill.—Henry Lantz, Walter E. Lantz.
Peoria, Ill.—D. H. Maury, jr.
Plattsmouth, Neb.—T. H. Pollock.
Quincy, Ill.—D. R. Gwinn.
Racine, Wis.—W. H. Laing.
Reading, Pa.—Emil L. Neubling, Frank A. Tyson.
Rochester, N. Y.—Thomas J. Neulle.
Savannah, Ga.—H. M. Lofton.
San Francisco—Stanley Forber.
St. Louis—C. H. Eppelsheimer, B. H. Saunders.
St. Paul—John Caulfield and wife, P. O. Dwyer.
Sioux City—Phil Carlin, James Coveny, F. W. Foster, F. L. Hagan.
Syracuse, N. Y.—M. R. Hill and wife.
Springfield, O.—George C. Colter.
Stromborg, Neb.—J. A. Carison.
Texarkana, Ark.—R. A. Munson.
Toledo, O.—C. S. Brown and wife, Lilla A. Payne, Edna J. Brown, F. R. Cook, E. W. Estsell, William Jones.
Troy, N. Y.—E. E. Roe.
Wakefield, Mass.—Thomas E. Duyer.
Wilkinsburg, Pa.—W. A. Alexander.
Wilmington, Del.—J. A. Bond, James C. Van Trump.
Worcester, Mass.—John O. K. Otiss.
Youngsstown, O.—J. H. Morris, W. S. Hamilton and wife, Miss Grace Hamilton, W. F. Simpkens.

SPECIAL CONTRACTS IN WATER-WORKS BUSINESS.

By D. H. Maury, Jr., M. E., Superintendent Water-Works Company, Peoria, Ill.

By far the larger number of services in any water works system, will be those of private dwellings, and it is more particularly with regard to these services that rates are usually fixed by ordinance. The taps and services, and meters, if any are used, are small. As a rule, these services are not expected to furnish water power nor fire protection, nor any large quantity of water in a short period. They are simply "ordinary services," and are those to which the rates, as fixed by ordinance, are intended to apply.

But when a prospective consumer desires an unusually large supply of water, or exceptional facilities for the use of it, or special rates for the water supplied, or extraordinary privileges of any sort, then his service cannot be properly nor equitably treated by the rules which govern ordinary cases, and his supply should form the subject of a special contract.

Such contracts should be more remunerative to the water department than the supply to an ordinary dwelling, and the soliciting and securing of as many of these large contracts as possible, is one of the most important duties of the business manager of a water works system. It is of the nature of such contracts that each one must be treated separately and considered on its own

merits, and the first essential to success is a careful study of all of the conditions of the case.

A personal inspection of the premises to be supplied should be made by the water works superintendent, and in his search for accurate data, nothing should be overlooked which can in any way contribute to that thorough knowledge of the subject which should be his before he submits his proposition to his prospective customer. This knowledge should cover not only all the details of the manager's side of the subject, but should also be as full as possible on those matters which might influence the consumer in his decision.

Let us suppose, for example, that the manager sees an opportunity to negotiate a contract to supply a large office building with water for running its elevators by direct pressure from the city's mains, for fire protection, and for the general uses of its tenants. We shall take it for granted that the city water pressure is adequate for the purpose and we shall assume that the owner of the building has his own boiler plant, which he uses to heat his building in winter, as well as for making steam to run his elevator pumps and the pump supplying his general uses for the entire year, and that his own wells on the premises furnish his water supply. It would be necessary for the manager to ascertain the diameter and stroke of the elevator piston, the number of feet the cage will travel for each lineal foot of piston travel, the required speed of the cage, and the water pressure necessary to drive the piston fast enough to produce that speed with the maximum load on the cage; the diameter of the service pipe which will supply from the main a sufficient quantity of water at the desired working pressure; the cost of such a service pipe, with all the attendant items—tapping the main, gate valve and box in the street, and all necessary valves, connections, air chambers and fittings in the building; the cost of an elevator counter to record the travel of the piston—and thus measure the water used; the cost of a meter for the house supply, with separate service and stop cock and box, if necessary; and the cost of a separate connection for fire protection, if required.

The probable average daily quantity of water that will be used for the elevator, should next be arrived at, either by putting a counter on the elevator for a sufficient length of time, or by having a reliable inspector count the full and partial trips of the elevator for one or more average days. The house supply should be arrived at either by metering it, or by making as careful an estimate as circumstances will permit, after an inspection of all the fixtures and uses of water, and allowing a margin for safety.

The manager, when he has learned these facts, and coupled with them his knowledge of what will be added to his operating expenses—if he undertakes to supply the building—will be in possession of most of the data necessary from his own point of view. He must now go further and look at the case from the point of view of the owner of the premises.

He must learn from the owner the amount of his yearly coal bills, and must separate from this amount, the coal used to heat the building in winter, leaving the coal properly chargeable to running the elevator, and to pumping water for the general uses of the premises. He must also learn the salaries of such engineers, firemen or other employes as may be employed to run the pumps and boilers, and to keep the machinery in repair, and who would not be required if the elevator power and house supply were furnished directly from the city's mains. To this must be added such proportion of the cost of oil, waste, packing and repairs to machinery and boilers as would be saved by a direct connection with the mains. The manager should also ascertain the number and size of standpipes and hose openings for fire protection, or the extent of the automatic sprinkler system; the probable value to the owner of such fire protection system in actual reduction of his insurance rates, and as a safeguard against loss of business in case of fire—against which the owner cannot insure. The possibility of competition by electric power companies must also be considered, and the first cost and operating expenses for such power should be figured as closely as possible from the data available.

As advantages which might weigh with the owner in inducing him to take his supply from his city's mains, there should be mentioned, amongst others, the following: Freedom from heat, dirt and annoyance of a boiler plant during the winter months; when the plant would be required for heating; the advantage of having a city pressure ready at all hours of the day and night, and at all seasons; and the value to the owner of such parts of his plant and machinery as he might be able to dispense with and utilize by sale or otherwise, if he elected to take his supply from the water mains.

In short, the manager, knowing what it will cost him to supply the desired service and whether he has the water to spare, will

also learn how much the owner of the premises is at present paying for the service he is getting, and the manager will then be in a position to know whether he can offer the owner the same or better service at an attractive rate. When his proposition is submitted and has been accepted, the manager will have the satisfaction of feeling that he has made a contract which, while advantageous to the other party to it, and probably based upon rates lower in proportion than those fixed by ordinance, is yet a source of more revenue to the company or water department which employs him, than a large number of "ordinary services."

The search for new business is sometimes attended with difficulties, and the path to a final settlement is not always strewn with roses; but, as in every other business, good nature and courteous treatment will do wonders.

The writer can recall but two instances—both taken from the experience of a friend—in which the manager of the water company, after having exhausted every means of conciliation, was forced to resort to drastic measures. In the first case, the owners of the premises supplied by a six-inch unmetered pipe, extended this pipe across an intervening lot and into another building, and when detected some months later, refused to make any settlement therefor. After abundant opportunity had been given to these parties to make a reasonable adjustment of the question at issue, the manager turned off the water and severed the six-inch connection with the main. Within twenty-four hours, a satisfactory contract was agreed upon.

The second case was that of a consumer to whose premises a large service pipe and meter had been put in at his request at the expense of the water company, with the understanding that a large supply of water would be taken. The consumer took no water, but supplied his building from wells sunk for the purpose, and used the water company's connection for fire protection only. Upon his declining to pay for this service, the large meter was replaced by a small one, with the result that a contract was almost immediately concluded.

In both of these instances, all differences have been settled and harmony now reigns.

Instances could be multiplied in which patience and forbearance on the manager's part, without any sacrifice of principles at stake, have sufficed to bring about results which, with every technical and moral right on his side, could not have been accomplished by a mere dogged and unyielding insistence on the letter of those rights.

Special contracts should be as clear and explicit as possible, and should be so drawn that while not unfair to the consumer, they should fully protect the water company or water department against all possible contingencies.

Large contracts, as a rule, do not come unsolicited. They must be sought after, and with just as much energy and perseverance as sales in any other business where competition is keen. The city directory will give a list of all the office buildings, commission houses, wholesale establishments, large stores, factories and industries; and among these is the field in which the enterprising manager will seek for new business. The files of the local papers, and the list of building permits issued, will keep him posted as to any changes or new constructions; and it is very much easier to make a contract for a supply from the water mains beforehand, than after the premises have been equipped from other sources with the facilities desired. Every employe and inspector should be instructed to report anything that might serve as a clue to new business; and much which would otherwise escape the manager's knowledge will be learned through the vigilance of his subordinates, if they are encouraged to be on the lookout for useful information. The manager who, while discharging all of his other duties ably and conscientiously, has been content to take only such new business as the natural growth of his city brings into his office, will be truly surprised to see how much can be added to his revenues without a corresponding increase in expenditure, by an active business canvass for special contracts.

LAYING SMALL-SIZED WATER MAINS.

By John B. Heim, Superintendent City Water-Works, Madison, Wis.

In fourteen years we have laid eighteen miles of water mains, the minimum in any one year being 1,200 feet, and the maximum three and two-fifths miles. This was mostly laying branches connecting one street with the other which are either 332 or 660 feet, the length of a block, and included the very pleasant job of inserting specials which had been omitted. Notwithstanding these short stretches, additional labor and specials, the average cost per foot was only seventy-six cents. This also included hydrants and valves. We generally employ from twelve to eighteen diggers, and a few elderly men unable to do hard work to trim up.

Our method for digging is to mark out for each digger what we call a section. This is 12 feet long, two and a half feet or more wide, and from five and a half to seven and a half feet deep. This trench the digger must have in complete order, having removed all obstacles (unless there are bowlders too large for one man to handle), ready to lower the pipe. For this work, we pay from seventy-five cents to one dollar a section, and the men have earned from forty-five to sixty dollars per month, including rainy days and Sundays. This looks like high wages, but the result showed that at no time did the city pay over $1.50 per day. All laying of pipe and the covering of same is done by day work.

While the diggers prepare the trench, the caulker prepares the pipe of the 4 and 6-inch pipe; when we lay a 4-inch main we always join three lengths together, and lower the thirty-six feet at once. When a 6-inch main, two lengths of pipe are joined together and lowered. Larger sizes are lowered in single lengths, and a fewer number of men are employed.

The pipe is always lowered by the diggers and covered by being hand-filled, tamped in layers and settled with water where we can reach it. The trench is filled compact and solid. No large stones or bowlders are allowed to be put into the trench. The final trimming up is done by the extra men as stated above. To lower the pipe we use a tripod made of 2-inch gas pipe, with an ordinary tackle and double slings, and for the large pipe the differentials.

The gain we make through piece work is in the rapidity with which we lay our mains, the saving of the caulkers' time, and in the pig lead. As an illustration: In 1887 we laid 660 feet of 4-inch pipe of from five to seven feet in depth, through sandy soil, connecting with mains at both ends, and including two valves, in thirteen hours, with eighteen men, at a cost of forty-three cents a foot.

RELIEF FROM VIOLENT FLUCTUATIONS IN DIRECT PRESSURE WATER SUPPLY.

By John B. Heim, Madison, Wis.

Our water supply system is the direct pressure. The city lies on seven elevations, and is known as the seven hill city, the same as ancient Rome. The highest elevation is seventy feet above pumps at station. This naturally causes violent fluctuations in the pressure through a sudden closing of hydrants, the breaking of hose in case of fire, the flushing of mains, the use of hydrants for sprinkling carts, or water motors and elevators. All are liable to cause a variation in pressure up to forty pounds, and violent strains on the machinery, services and fixtures.

To overcome this difficulty and to give temporary relief from these sudden variations in pumpage and violent changes in pressure, we provided or attached an air chamber on the sixteen-inch supply main near the pumps connected with a fourteen-inch pipe and a fourteen-inch valve. The chamber is made of riveted one-half inch steel plate, five feet in diameter and twenty feet high, able to carry a safe working pressure of 200 pounds. At ordinary working pressure the chamber is filled with air. During a rise in pressure from seventy-five to 150 pounds, the chamber takes in about 200 cubic feet of water, and the expansive force of the air in the chamber promptly

returns this water to the mains, in case of any sudden demand for water, beyond the capacity of the pumps, at the speed at which they may be running, and it gives them time to gradually increase their speed to the requirements of the service, and in case of a sudden reduction in quantity caused by the closing of hydrants, causing a diminution in the draught, the chamber is again able to take up the corresponding excess of water, and gives the engines time to come down to their normal speed without strain, shock or breakage.

This air chamber is available at all times, whether we carry domestic or fire pressure, as a source of immediate supply, and affords a great relief to the violent fluctuations of pressure at such times. It is efficacious in all its intents.

At the bottom of the air chamber is a three-inch drain pipe, and at the top a two-inch feed pipe connected with a small receiver which has a set of valves so designed that it can be relieved of the pressure in the air chamber and the water exhausted from it, when it will fill with air. By changing the position of the lever at the receiver, the air contained in this receiver will then be forced into the air chamber by the water flowing from the latter to the former. This air chamber was attached to the system in 1892. To ascertain the actual benefit derived by its attachment, we decided when at leisure to make severe tests under all conditions, and its effect on the system, which was done between February 19 and March 6, 1893. We give you an average test made on the 20th and 21st of February, of ninety seconds at a time, with the sudden opening and closing of hydrant 200 feet from the pumps, discharging water from a ten-inch main.

At the Park hotel, which by its elevation above pumps reduces the pressure to thirty pounds, an elevator is connected direct with our mains requiring 100 gallons of water to lift the same to the fourth story, and detrimental to a direct system a test was made which resulted as follows:

With air chamber cut off, the pressure dropped at the gauge in the station from eighty-five to sixty-five pounds in twenty seconds at the rise of the elevator, and returned to eighty-five pounds in twenty seconds at the stopping of the elevator, and a continuous vibration of the pressure gauge of from six to seven pounds, whereas, with the air chamber the pressure dropped from eighty-three to seventy-five pounds in six seconds at the rise of the elevator, and increased from seventy-five to eighty-three pounds at the stop of the elevator in six seconds, and the continuous vibration at pressure gauge was within three pounds. This was with one lift of the elevator. Through the sudden opening of the hydrant with air chamber, the engine speed was increased from forty to forty-five revolutions in twenty seconds, the pressure in main dropped from seventy-one to sixty-seven pounds and increased to seventy-two pounds in twenty-five seconds. The sudden closing of the hydrant increased the pressure from seventy-one to seventy-five pounds, and the decrease of speed was from forty-five to forty revolutions. Without the air chamber, the engine speed was increased from fifty to sixty revolutions, the pressure in mains dropped from eighty-three to sixty-three pounds in from eight to ten seconds. By the sudden closing of hydrant, the engine speed dropped from sixty-one to forty-nine revolutions, the pressure in the mains increased in proportion. The engine was not under control of the governor, but at the mercy of the pressure.

The air chamber has been attached for nearly five years, and has proven itself beyond a doubt the climax of a direct pressure system, a great deal less expensive than a standpipe, and is always ready under whatsoever pressure. The cost of the air chamber, aside from the connecting, was $1,150.

INCREASED REVENUE, FREE SERVICE PIPES AND FILTRATION.

By Dow R. Gwinn, Superintendent of Water-Works, Quincy, Ill.

In all branches of business the question that frequently suggests itself is, "How can the revenue be increased?" and I have no doubt that this subject is full of interest to those who are in the water business. There is one fixed charge to be met, the interest on capital invested, besides the ordinary expenses of operation, and with most private companies a good round sum for taxes. On the other side, there is the hydrant rental and receipts from private consumers. The tendency is for city officials to order as few hydrants as possible and cut the rate down at the same time—that is, if they are in a

position to do so. Then with private consumers there is a certain class of business that can usually be counted on, such as factories, stores, office buildings, livery stables and dwellings with modern plumbing. When these are all supplied the receipts do not increase as rapidly as formerly, except in cities that are growing in population and extending their limits, unless an exra effort is made to get customers to whom some inducements must be offered.

The city in which I reside was nearly as large when the water works were completed as it is today, and each house was provided with a cistern or two that contained according to the owner, the purest of water, although some had not been cleaned in a score of years. The small householder would get along after a fashion with his cistern, and unless he would rebuild or was very prosperous, he would not go to the expense of laying a service pipe. We wanted to increase our revenue and decided to offer a special inducement to this class of people to become customers. First we made our rates for family or domestic use very low, $2.50 for two-room house, $3.60 for three rooms, $4.50 for four rooms and $5.40 for a five or six-room house and offered to lay the service pipe to the curb line free or charge, if the owner of the property would sign a contract to use water and pay the rate for his house regardless of the size, for a term of three years. The contract reads as follows: "In consideration that the water works furnish and lay at their own expense a service pipe and all usual and necessary appendanges, from the street main to a point just inside the curb line in front of premises No. —— street, the undersigned hereby agrees that —— will pay to —— water works the sum of —— dollars per year —— (less discount of 10 per cent. if paid on or before the 10th day of month when bills are due) for the period of three years for the privilege of using water at said premises for the following purposes only, viz:

"The charge for water will begin at the time said pipe is laid by —— water works and water turned on it. In case of removal from above premises by the subscriber before the expiration of this agreement —— liability under it shall cease."

The result was that many became customers who would not have done so if they had been compelled to pay the whole expense of laying the service pipe. Formerly a service laid from the main to a point, say 10 or 12 inches inside the fence provided with a yard hydrant, would cost the prospective consumer $17 to $20. Now he can get it for about $7, an expense which can be afforded by even those in very moderate circumstances, and some who are starting new places save the expense of a cistern by accepting our offer. When the three years have expired, as a rule the consumer continues to pay for water, as he has become accustomed to the superior water which we furnish and finds it easy to pay $1.35 to $2.70 once every three months. Frequently the rate is increased by adding sprinkling, or if water was originally taken for sprinkling only, the domestic is added.

Some of the members of this association will ask about manner and cost of laying service pipes, and I will answer that we have most of the work done by the plumber selected by the applicant to do his work, except where the main is being laid, when we do the work ourselves. We do not include the price of the corporation stop or the tapping of the main, because we always do that for any customer, free of charge. First, there is a piece of ¾-inch strong lead pipe, 2 feet 6 inches wiped on coupling or corporation stop and brass soldering nipple, then sufficient ¾-inch galvanized iron pipe to reach a point about 1 foot inside curb line where the curb cock is located, on which a curb or pave box is placed. The curb cock is of the pattern with tapering core or plug which does not stick and is always easy to turn.

Where the main is about 12 feet from curb line nearest the premises to be supplied, the cost is $5.25, and where it is about 30 feet the cost is $7.25, or an average of $6.25. The plumbers will not get rich at these prices, but when the work is done in connection with the extension of the service into the premises of the consumer, they do not lose anything; at least they are anxious to do the work. When we do the work ourselves at the time the main is being laid, we can save about one dollar each service.

Take the average expense of a service laid to curb by plumbers at $6.25; the interest on this investment at 6 per cent. is only 37½ cents per annum, which is a small outlay to secure a steady consumer, and in addition there is a point that should not be overlooked—that is, the good will of the consumer, who, in many cases, appreciates the fact that he has been treated generously.

Another way of increasing revenue, and by far the most important one, is to filter the supply before delivery to consumers. It is an undisputed fact that purchasers will buy more readily and pay more cheerfully for a first-class article than for a poor one, and this applies to water as well as any other commodity. The time is coming when a system of filtration will be considered as necessary to a complete water plant as a pump, reservoir or standpipe. Personal ex-

perience has proven that our business has improved wonderfully since we began filtering the water and laying service pipes to curb. The filtered water being desirable and far superior to cistern water, those who did not have it were inclined to become our patrons, and by making it easy for them to do so, by assisting them in getting service pipes at a small expense, naturally the business began to grow. A short description of our system of filtration may be of interest. First the water is taken from the Mississippi river at a point above the city, free from local contamination, delivered through a thirty-inch conduit 1,500 feet long into a well, from which it is pumped to a settling busin 70 feet by 70 feet and from 7 feet 6 inches to 9 feet 3 inches in depth, where a large proportion of the suspended matter is precipitated, the clearest water flowing into a steel trough, which conveys the water to the effluent well, from which it flows by gravity to fourteen filter tanks made of cypress staves, the tanks being 12 feet in diameter. Here the water passes through about four feet of fine quartz and sand into a cemented basin below and is then pumped into the mains and reservoir. A small pump delivers a solution of sulphate of alumina into the discharge pipes of the first pump. giving ample time for coagulation. When the river is soft, which is the case after heavy rains, we use lime water in the pump well, thus supplying carbonate of lime for the alumina to act upon. This has proven an economical measure, as less alumina is required when the carbonates are present in large quantities, and compared with sulphate of alumina lime is inexpensive. The river has been unusually high this spring and the water was about as bad as it could be, laden with impurities of all kinds and very dark in color, yet with the use of lime water and about two grains of sulphate of alumina, we were able to filter this water successfully and maintain the usual high standard. As a rule water consumers are inclined to find fault, but it is quite a common occurrence to have our customers praise the water furnished them. This means increased revenue, for a satisfied customer will tell his neighbors and that helps to secure additional business. While the worst water we have ever had was filtered with the use of two grains of alumina per gallon; the average will be considerably below that figure, not more than one-half grain per gallon, which at 1½ cents per pound is $1.05 per million gallons. Our average for four years was four-tenths grain per gallon pumped.

Now what is the effect of filtered water on typhoid cases? Several years ago there was an outbreak of typhoid fever in Quincy and an investigation was ordered by the city officials. The report of the investigation as published in a local paper was as follows: "It is a bit peculiar that in seventeen of the nineteen cases of typhoid the source of water supply was cisterns; one of the remaining two came here sick from St. Louis, and the remaining one had used city water. This either speaks well for the hydrant water or is an argument against cistern water." The record for the year ending April 1, 1897, for the city of Quincy, Ill., was seven deaths, including the patients that were brought to the hospitals from the government works on the river below the city. Of this number of fatal cases only one was on premises supplied with filtered water, which is certainly a strong argument in favor of filtration.

Where meters are used to any extent the expense of repairs with clear water is considerably less than when the water is muddy. The year before we began filtering the water, 40 per cent. of the number of meters in use were stopped from various causes, principally by grit and foreign matter and last year only 11 per cent. of the total number in use were disabled, although about half of our meters are five years older.

There is no part of a water works plant that is so largely and promptly remunerative as a filter plant and it pays a larger interest upon its cost, due to increase in revenue and saving in other directions than any other portion of the works.

In conclusion I will say that outside of increased revenue, there is a feeling of great satisfaction in supplying water of unquestionable purity to one's neighbors and fellow citizens, in feeling that they get the best that can be had and that the responsibility resting on the water purveyor has been conscientiously discharged.

FAULTY CONSTRUCTION IN WATER-WORKS PLANTS.

By W. L. Cameron, Galveston, Tex.

It is acknowledged that there are many poorly constructed water works plants in the country. This cannot be entirely attributed to the engineer in charge. He has many difficulties to labor under—a limited amount of money at his disposal for the construction being one of the most important drawbacks, and often the principal one. The rapidity with which the number of works have been increased in the country, during the past twenty years, and the methods by which franchises have been obtained, and disposed of has had considerable to do with it. Works that should have been carefully planned and erected upon a firm and efficient basis have been pushed rapidly and cheaply to completion. The simple fact that they were capable of performing a certain test when completed, being considered by the inexperienced official of the several city governments, as a sufficient proof that they were capable of withstanding the wear and tear of years, they not taking into consideration the fact that the plant at the time of the test had no domestic demand upon it.) In many instances these works were constructed simply to sell—when finished, I do our fraternity the justice to say that I believe no one of them would give their countenance to poor construction. This sudden demand for the erection of water works has brought into the field many men who had no experience, as projectors and constructors. Whatever the reasons, (and they may be many) the fact is plain that all over our country may be found poorly constructed water works. Whom does this reflect upon? I think it reflects to a certain extent upon our association.

One of the main troubles also has been the fact that there is nothing on this earth that the general citizen thinks it is easier to be, than a "skilled water works man." When private companies are organized in a city nine times out of ten the officers who will have much to do with the overseeing of the original construction are friends of the investors, or the investors themselves who have had no possible way of becoming familiar with this special business, up to that time. It is a very difficult matter, as you have no doubt observed, to convince a man who has "read up a little" upon a subject of this kind that he is not capable of giving much advice on all matters pertaining to the business. The expert employed is either bound to give up some of his plans, (known to himself to be absolutely necessary) in order to cater to this species of dictation, or to the other no less injurious one, to save money, or give up the job.

The main point seems to be with this class of water works projectors to make a contract for fire hydrant rental that will bring in sufficient revenue to pay all the interest upon the investment—when he has his garment "he must cut his cloth so as to fit" and the result is (not a plant that will be adequate) but one that will stand sufficient test at the beginning, and claim to earn the money necessary to pay the interest on the bonds. Some instances have occurred where the record of the pipe system has either been not accurately kept, during the progress of the work, or purposely doctored—the map in the office of the company may possibly show a 10 to 12-inch pipe upon a certain street, when the fact is that it is only an 8 or 6-inch main. One would not care to think that this could possibly be done in order to take advantage of a possible future purchaser. That such errors are in existence I know from personal investigation.

Insurance inspectors make their maps and reports from the records in a water works office, and insurance rates are based upon the size of a main pipe in the locality where the property may be located, which is to be insured. You will note how misleading this is to the insurance board of underwriters when there are errors in the pipe records. In some instances, however, the agents of the insurance companies have themselves made the mistake of putting the wrong sizes upon their own map, which is then not even a copy of the water works map from which it has been taken. The repeated failures in many cities to have adequate pressure and water in time of fire, has led to investigation upon the part of the board of underwriters, and others, and these officers are now much more apt to depend upon a statement made by a chief of the fire department, and the chief is bound to make his report and his opinion upon the results he obtains. I am aware that there have been instances where a chief or his aids have through ignorance or for some special reason, misused the fire hydrant of the water system at his command, yet these cases are rare, and when the causes of failure of a sufficient supply

have been sifted down, it has generally been found to be the fault of the water department.

The manager of a works should make it a rule at all times and in every way to work in harmony with a fire chief. If he has a good plant there is no one who can assist him better to show it off than the fire department, and if he has a weak one, he needs much more the co-operation of the chief. The condition of affairs, suggested as existing in some places by the above thoughts, will in my opinion account in a measure for the present high rate of insurance in some of our cities. All capital is timid and there is nothing that requires so much confidence as a board of fire underwriters. They have been burned so often that they have become very careful—in fact, in some instances, I think make well protected places pay for the faults and defects found in poor ones. The insurance interest is becoming instructed in water works construction and management, and a neglect to present them a standard water works plant and an intelligent and conservative management puts upon the citizen who desires to insure his property an increased rate of from 10 to 25 per cent. in those places. The drawback that a high rate of insurance gives to a town is too well-known to need comment.

THE QUESTION DEPARTMENT.

[By J. W. Howard, B. L., C. E., for MUNICIPAL ENGINEERING.]

SHAPE OF GUTTERS IN SMALL NORTHERN TOWNS.

Required a macadamized street with cobblestone gutters; walk on one side of street two and one-half feet above walk on the other; snow remaining on street several months during winter to be considered; also sudden thaws. What form of cross-section do you recommend?

A. G. Ardagh, Barrie, Canada.

This class of problems has often arisen and is best solved by "dishing" the gutters at each curb provided they are made of paving stones well set in good fine gravel, mixed with sand, and firmly rammed in place. The width of your street would probably permit making the depth of the gutter at the lower curb or border stone four inches, and on the upper side of the street

Fig 1

Fig 2

eight inches. The rise of the roadway at the center must be determined by local conditions, which we do not know, especially the width of the street. This construction would be more permanent and would do less damage than if the arc of the street were continued to make an acute corner in the gutter at the intersection of the stone paving and the curb. Figure 1 indicates the wrong way in cold climates, figure 2 the right way.

CEMENT BICYCLE TRACKS.

Please state where a successful cement bicycle track exists concerning which I can get information.

M. B. L., Pittsburg, Pa.

In Garfield Park, Chicago, concerning which information is given in MUNICIPAL ENGINEERING, Vol. XII, No. 4. Further information can be obtained by writing to the engineer of the West Park Board, Chicago.

TREATISE WANTED ON RACE AND CYCLE TRACKS.

Please recommend a book or paper on construction of horse racing tracks, also on bicycle tracks. *J. F. B., Marlboro, Mass.*

We know of no book or special paper on this subject, as the tracks are all so nearly alike as to probably not call for a special treatise. The tracks are usually made from

the best material available in the vicinity and on the system of a macadam base with a well rolled mixed gravel and clay surface. The "eclipse" form of track has been replaced at a few places by what is known as the "kite shaped track." If our readers can contribute any information it will be welcome.

STEAM ROLLERS VS. HORSE ROLLERS FOR ROADS.

Is steam rolling cheaper than horse rolling on macadam roads, and what is the kind of steam roller best for us to purchase? *Supervisor, Chester County, Pa.*

With very few exceptions on very small amounts of work, it is cheapest to purchase and use the steam roller as shown in detail in Vol. 10, page 194, of MUNICIPAL ENGINEERING. If a steam roller is used only forty days in the year, $95 will be saved by purchasing and using a steam roller, and if the steam roller is used one hundred days in the year, the saving amounts to $935. This includes interest, repairs and operating expenses of both. The steam roller, in addition, does much better work.

We can simply state that the best class of rollers for macadam, etc., is that class which has two large driving wheels which are themselves rollers, and a small leading roller used for steering.

MACADAM FOUNDATION FOR PAVEMENT.

Is paving on six inches of macadam, thoroughly rolled and then covered with two inches of sand and one course of paving brick, as good as two courses of brick on sand without any macadam foundation? Our city is about to do some paving.
Le Grand Paving Co., Marshalltown, Iowa.

It is best to properly grade out your street the depth of one course of brick, two inches of sand, and six inches, but better eight inches of macadam foundation. Then roll the subsoil with a steam roller. On this, place at once the macadam six or eight inches thick, by layers, and consolidate it thoroughly with a steam roller. Then finish with two inches of sand, and paving bricks firmly set. Set the bricks closely together and fill the joints with asphalt cement, cement-grout or sand. The work should not be done in cold weather. Be sure the subsoil is drained and the street so paved that it will quickly shed water crosswise and lengthwise. Water is the foremost enemy of pavements, especially in small cities where the traffic, because light, does little harm.

SPEED OF RAILROAD TRAINS IN EUROPE AND AMERICA.

Please state the speed of railroad trains run regularly between the principal cities of Europe and United States, to show which runs the fastest, as I have been unable to find this anywhere?
N. B. Abbott, Madison, Wis.

Although this does not belong to MUNICIPAL ENGINEERING, through the kindness of a railroad office in New York we have worked out the following table—special trains are not given, only those run regularly; the time includes stops.

	Miles.	*Hours.*	*Miles per hour.*
Paris to Cologne	301	12	25
London to Glasgow	396	9	44
Berlin to Vienna	438	15	29⅕
New York to Buffalo	440	8¼	53⅓
Paris to Rome	905	34	26½
Berlin to St. Petersburg	985	44	22⅓
New York to Chicago	980	25	39⅕
Paris to Vienna	1,068	40	26¾
New York to St. Louis	1,066	30	35½

ANALYSES OF TRINIDAD LAKE ASPHALT.

What are the analyses of crude Trinidad lake asphalt and refined Trinidad lake asphalt which are so often mentioned in connection with pavements?
R. P. Rollins, Memphis, Tenn.

The analyses made by different chemists vary with their experience and the methods used. The usual method used by men engaged in the

industry of asphalt paving is by solvents, of which carbon-disulphide is the principal one. To fully answer this question more space would be required than is here possible to allow. The crude asphalt from the deposit known as the asphalt lake on the island of Trinidad, varies slightly in composition, according to the portion of the lake from which it is taken and whether taken in very wet or dry weather. The average of several analyses made in Washington at the government laboratory of the crude material and of several analyses made at the Columbia University, New York, are as follows:

	Columbia Uni.	*U. S., Wash.*
Asphaltum	39.83	38.14
Earthy matter	33.99	26.38
Vegetable matter	9.31	7.63
Water	16.87	27.85
	100.00%	100.00%

Rejecting the water as not properly a fixed part of the crude material, although always absorbed by it, the analyses of the dry crude asphalt would be :

Asphalt	52.87
Earthy and vegetable matter	47.13
	100.00%

The refined Trinidad lake asphalt varies a little, according to the method used in refining. A careful examination of official reports and analyses by experienced men indicates the following as a fair average analyses of the refined as used by many cities for compounding pavements:

Asphaltum (pure bitumen)	57.00
Organic matter	7.00
Mineral matter	36.00
	100.00%

Some samples show a little more bitumen and less organic matter.

The value of asphalts for paving must not be determined by the analyses alone, but by various solution and other tests, combined with the physical as well as the chemical nature of the materials.

TITLES TO MEXICAN ASPHALT DEPOSITS.

Is the title to the Mexican asphalt deposits good? *G. M., Austin, Texas.*

This question can not be answered in a general way, because the deposits of asphalt of Mexico consist of scattered outcrops or springs mostly of very soft bitumen, which should be classed rather as a maltha than as asphalt, and they belong to many owners, estates, companies and the government. Leaving out those which are inaccessible, as a rule, according to our information, the titles are not clear, nor the leases free from legal complications, especially, because of old obligations incurred and not met, and protracted litigation due partly to Mexican methods and partly because it often becomes necessary to consume much time through official correspondence through the diplomatic and consular bureaus. There have been many attempts, beginning in 1865 with a large English company, to develop the supposed resources of petroleum and incidentally soft bitumen and asphalt deposits in Mexico. There is a complication of titles to these properties which will eventually require some special legislation of the Mexican government to put them in a satisfactory shape.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

PIPE SEWER OVER A CREEK.

What is the best way to put a pipe sewer over a creek just above the water so that sewage will not freeze in the pipe? *W. W., Niles, O.*

The answer to this question depends very much upon the climate. South of the latitude of Philadelphia (roughly speaking) no precautions

need be taken. An iron pipe will probably be necessary, and if it is made small enough so that the ordinary flow of sewage will practically fill it the warmth of the sewage will prevent freezing. Such a pipe would act under a slight head in case of storms. In colder climates an iron pipe surrounded with packing of some non-decaying substance such as mineral wool, protected by a wooden box or vitrified pipe or a large iron pipe, will be all that is needed.

HOW TO CONSTRUCT A RESERVOIR WALL.

We are building a masonry reservoir on a hillside having a slope of about 45 degrees, mostly rock excavation; elevation, 206 feet; dimensions, 50x100 feet; depth of water, 12 feet; wall to be 11 feet* thick at base, stepped up to 4 feet at top. Will you give your views as to what will make this a perfectly secure reservoir?

T. V. Irwin,
Treas. Patterson Water Co., Mifflintown, Pa.

The security of a reservoir can be properly judged only by an expert after a careful examination of the ground. If the walls on the open sides are founded on rock, proper care is taken to make a complete junction with the base and the seams in the rock are all made water tight, the reservoir as described may be perfectly secure, but if part of the wall is founded on the earth, the rock is rotten and the work poorly done, it may be quite the reverse. The best methods of making the structure safe depend upon both character of work and materials and cost, and can only be determined by the expert examination recommended.

*The figures in the copy are not clear, but appear to be 11 feet, as given. The answer is based on the supposition that the thickness of the wall at the base is about 12 feet. If materially less the writer would regard it as not thick enough.

CONSUMPTION OF WATER BY BOILERS.

What would be the consumption of water for ten hours for an 80 h. p. boiler carrying 90 pounds of steam?

Chas. W. Werks, Rouse's Point, N. Y.

The ordinary rule for rating boilers is 30 pounds of water evaporated per horse power per hour, which would give 2,880 gallons of water used in 10 hours. The amount of water used depends upon so many conditions of kind of boiler, rate of working, leakage, etc., that this can only be considered an approximate result. Thurston's rule is to divide a constant which varies from 150 to 200 by the square root of the pressure, which, within the common range of pressures, would make the amount vary from 15 to 25 pounds per horse power per hour. Of course, if the boiler is worked at less than its rated capacity of 80 horse power, it uses proportionately less water, and, on the other hand, it will use more if it is crowded.

BY WAY OF COMMENT.

New Water Supply for Schenectady. The city of Schenectady, N. Y., has recently completed works for a new water supply after much discussion of the matter, many experiments and much expert investigation. The works were originally constructed by a company which obtained a supply from the Mohawk river in front of the city and distributed it largely through Kalamein pipes. Some years ago the city purchased the plant, and has made many improvements in both supply and distribution. The intake was retained in the old location opposite the city until the completion of the present works. It was not badly located at the time of its construction, but the General Electric Company moved to the city in 1887, and the following years added a rapidly increasing amount of pollution to the river above the waterworks intake, which finally became unbearable. Some attempts were made to obtain water from other sources than the river, but without success in finding a sufficient supply except those made on wells near the river bank. The first such experiment was on an island, and showed that a supply could be obtained. This location was unfortunate, however, as it would be necessary to make large expenditures to protect the well and pumping machinery from floods and ice. Later experiments showed that a similar supply could be secured from wells about three miles up the river and about two hundred feet from the river bank.

The city of Amsterdam is located about eighteen miles above Schenectady, and discharges the sewage from a population of about 20,000 into the river. A bacteriological examination of the river by Charles C. Brown and James H. Stoller, for the city, supplementing examinations previously made by them for the state board of health, showed that under the conditions of flow existing in the stream, there was, under ordinary conditions, only a partial disappearance of the sewage in the flow of twenty miles between the cities, but that the location of either of the wells was materially better than the location of the old intake. The failure of the stream to purify itself was specially marked in the winter.

These facts and the abundance of water from wells probably led to the decision to construct the new works, and take the supply from a place where the water is filtered through about 200 feet of gravel. The collecting gallery from which the water is pumped is 60 feet long by 8 feet wide. Its bottom is 42 feet below the ground surface and 14 feet 6 inches below low water in the river. The height of water in the gallery is directly regulated by the height of water in the river. When pumping at the rate of 5,000,000 gallons a day, the level of the water in the gallery is lowered from 16 to 26 inches, and when pumping at the rate of 8,000,000 gallons a day it is lowered 20 to 36 inches. The present consumption of water in the city is

not far from 3,000,000 gallons a day. The gallery is lined with 12-inch by 12-inch white oak sheet piles with 3-inch by 4-inch Georgia pine splines. The water is admitted to the gallery through holes bored in the piles, 2¾ inches in diameter, each hole having a malleable iron ferule at one end 3 inches long, and having a net diameter after deducting the thickness of cross-braces of about 2½ inches. There are ten of these in each pile, or about 1,360 in all. Three 24-inch suction pipes lead from the gallery to the pump. Two of these pipes have branches leading to an intake in the river, for use in case of failure of the well supply for any reason.

The connection with the old system is through three miles of 24-inch pipe, there being three points of connection, each with 12-inch pipe. The pipe is continued with a diameter of 20 inches to a standpipe at the opposite and highest end of the system. This standpipe is 32 feet in diameter and 100 feet high.

The city is now congratulating itself upon the change from the muddy and polluted river water to the cool, clear and palatable water of the new supply. The effect upon boilers is yet to be determined, but no more trouble is anticipated than was experienced with the old supply. We are indebted to Mr. DeWitt C. Smith, water commissioner, and to Geo. T. Ingersoll, the superintendent, for the data regarding the new supply.

Economy of Good Engineering in Municipal Work.

The city council of Spokane, Wash., has voted to pave Main avenue with brick. This furnishes a text for an editorial in the *Review* calling for the best quality of material, the greatest solidity of foundation and the highest character of workmanship. These points are written about so frequently that they would seem to be an old story, but our American principle of rotation in office brings in a lot of new men every few months, who have not seen any of this literature, are not posted on the facts, and think a pavement is as easy to decide upon as the quality of a new coat and is of no more importance. However, the pavement lasts much longer than the official life of the ordinary city councilman, and requires more patches than the coat and patches that cost more. The city usually feels that it must have at least a good lawyer to take care of its legal interests, with expert assistance when he has a hard case, but is willing to leave its engineering and construction work to the ignorant hands of the council or a surveyor, sometimes called by courtesy an engineer. The fact is that in many cases, if the proper expert assistance in the engineering department had been secured, much of the business of the city attorney would be taken away from him, for a large part of his work is getting the city out of the difficulties that the other city officials have worked into. Then, too, the largest expenditures are in the lines requir-

ing expert supervision, and the many blunders of ignorance must be paid for. The taxpayer is patient or objects to the expense of the expert, because he is usually as poorly informed as his representative in council.

Duluth-Superior Bridge. A new bridge has just been completed connecting Duluth, Minnesota, with West Superior, which presented more than the usual number of difficult problems. It is located on practically the only site for a bridge, so that it must be built sufficiently large to allow for a considerable increase in traffic. It is low, and across a channel on which there is a very heavy water traffic of all kinds. The draw span is 491 feet long, giving two passage ways, each at least 200 feet in the clear. The channel spans for rafts to pass are 301 feet long. The bridge carries two railway tracks, two trolley tracks, two roadways and two sidewalks, is 60 feet wide and 100 feet high at its highest point over the first pier of the draw span. The draw is turned by electric power, the dynamos being located on the first pier and fed by a submerged cable from the electric power house of the city. A storage battery is provided for use in case of temporary disabling of the cable or the electric station.

State Highways in Massachusetts. The State Highway Commission of Massachusetts has made a report on a proposed state highway in the valley of the Merrimac, from the New Hampshire line to the sea. A small portion of the line has already been constructed and accepted by the commission under the law. A considerable length lies in the cities and towns of Lowell, Methnen, Lawrence, Haverhill, Merrimac and Amesbury, and is at any time likely to be incumbered with pipes, sewers and pavements. These portions are considered as city streets, to be kept up by the city authorities. There remains to be constructed about twenty-eight miles, which it is proposed to grade to a width of fifteen, twenty-one or twenty-five feet in various parts, and to macadamize to a width of fifteen to eighteen feet. The total cost is estimated at $370,243, an average of about $13,000 a mile. Some portions will require a large amount of grading and one or two bridges must be built. The estimates for macadamizing alone vary from $6,300 to $9,800 a mile on the different sections.

The road is not considered a through road in the sense of connecting places with large business interests requiring such a road, but it will be a means for farmers on the line to get to town easily and will become one of the finest drives in the country. There are nearly 200,000 people tributary to the road, and it ends at one of the finest beaches on the coast.

The western states do not yet feel wealthy enough to go into this kind of work, but the feeling would be different if a few such roads

were constructed. One such road in a county would be an object lesson showing the economy of spending the money, as well as the beauty and convenience of the road. The state of Massachusetts is small, and the highway commission has a small ground to cover. The wealth of the people per capita is also greater than in other states. These advantages cause the state to lead the procession, but do not affect the inherent economy of the operation, which is even greater in many sections of the west than in Massachusetts, as the natural roads are so much worse than in the latter state.

New York Water-Ways and Water-Power. The state of New York and the United States Geological Survey have united in a study of the water-sheds of that state for the purpose of determining the power they possess and methods of developing it. The state in 1895 took up the study of the upper Hudson, with aid from the Geological Survey in making maps, and Mr. Geo. W. Rafter, the engineer in charge, has made a preliminary report on the investigation. The objects of the survey were to determine the rainfall and the run-off of the upper river, and to determine the size of reservoirs necessary to control the river, so that there would be a certain minimum amount added to the flow on the lower river, a certain amount for the Champlain canal as enlarged under the new plans for the state canals, and the amount necessary to compensate the owners of water-power for the water removed for the canal. The report, while preliminary, and therefore in some ways fragmentary, is very interesting, and gives a large amount of valuable information. Further studies will be necessary before definite figures can be given. The structures shown to be necessary for the complete control of the river will take a number of years to build. Observation stations have been established to determine data where none are now available, and to supplement those heretofore obtained. An interesting section of the report is that showing the increase in water-power, part permanent and part seasonal, which will result from a proper management of the many reservoirs recommended. Some hints at methods are suggested. Mr. Rafter is now at work upon a report upon the water-power resources of other streams in the state for the geological survey, which does not promise to be so exhaustive, but will be of considerable value.

Asterionella in Brooklyn's Water Supply. Dr. A. R. Leeds has made a report for the Brooklyn water department on the cause of the bad taste and odor of the water last summer, and the remedy for the same. He states that it was due to the development of vast numbers of asterionella, a plant which secretes an oil-like substance which gives the water its characteristic fishy, salty, oily odor and taste. The conditions in

the Ridgewood reservoir are very favorable to the development of the plant. There is much silica in the water pumped from the wells into the reservoir, on which the plant feeds. Abundant light, gentle motion of the water, shallow water and absence of peaty or other coloring matter are also favorable to its growth. The only complete remedy is protection of the water from the light by covering. Filtration is expensive and not certain. The plant is not poisonous and the water is otherwise, and during most of the year perfectly satisfactory. Covering the reservoirs would cost $1,000,000. Chief Enginer DeVarona recommends a by-pass around the reservoir so that it can be cut off for cleaning and during the time that the plant is growing.

This report is somewhat different from the one by the health department, and goes back to the source of the trouble. The immediate construction of the by-pass is recommended, that it may be in use this season when the time of growth of the plant arrives.

Mobile Sewerage Proposition. The city of Mobile, Ala., has no easy problem in its sewerage. A system was designed some years ago, but has not been constructed. A suggestion—now under consideration—is that the sewers be constructed by a company, which, under an ordinance introduced into the council, would have a capital stock of $275,000, no stockholder to have more than $1,000 worth, and the city to have a representation on the directory. A schedule of fees for connections with sewers is made, ranging upwards from $5 per annum for a house of three rooms, and $1 for each additional room. Connection with sewers is to be made compulsory. The income is to be made applicable to payment of (1) maintenance and operating expenses, (2) interest at 6 per cent. on capital stock, (3) purchase of stock by city at face value.

A company proposes to construct the sewers and a system of pipes for furnishing hydraulic power, using the water where necessary for uplifting the sewage to carry it to a proper outlet. It is proposed that the city pay the interest on the cost of the sewers and the revenue from them be under the control of the city, and that the company derive its revenue from furnishing water for power to customers in the city.

The ordinance is apparently an outgrowth of the company's proposition. Neither are in satisfactory shape, and the safeguards of the city's interests are conspicuous by their absence. The expenses of maintenance and operation are practically out of the control of the city, the cost of construction and consequent interest charge have no limits, and there are no checks on the actual amounts expended. The charges for connections are excessive. The city can purchase at any time at actual value, but there

is no adequate method of ascertaining this value.

When a city has a limit of indebtedness, which has been reached, or for any other reason is unable to construct a needed system of sewers, it would seem to be possible to so guarantee the payments as to make it reasonably profitable for a company to assist the city, by constructing the sewers. The city should, however, prepare the plans and specifications and superintend the work of construction exactly as it would were the city paying the bills directly.

The company's franchise could probably be let to the one offering to construct the works for the lowest interest charge. Thus one company might bid a higher price at a lower rate of interest and secure the franchise from one bidding a lower price at a higher rate.

The city would pay the company an annual interest on the money invested by the company in sewers, according to the terms of the bid and contract.

Since the city has full control of the construction, and can determine whether it is of a satisfactory character before accepting the work, and the company is in effect simply advancing the money to the city for the construction, on long time, it would make the terms perfectly definite to make the price at which the city shall purchase the same as the first cost of the sewers. There would then be no element of chance increase or decrease of value, and the city would be in the same condition as though it had paid for the sewers in the first place. The city would, in effect be guaranteeing the interest on the bonds and stock of the company, and would have the privilege of paying for them at any time and taking the plant. The maintenance and operation of the sewers could be assumed by the city directly, could be paid to the company on statements of exact cost with or without a percentage of profit, or could be let to the lowest bidder.

The first method is doubtless the best. If the last method is adopted the maintenance should be let with the construction and would complicate the determination of the lowest bidder on the whole work. There need be no element of uncertainity in the contract.

The city can pay the interest and maintenance charge wholly or partly from the city funds raised by general taxation, from a special sewer fund assessed by benefits incurred, or by charges for connections. The most satisfactory method in most cases would be the first. If the last were used it would be necessary to make the rates for the entire system, and until all connections were made the city must make up any deficiency. It is contrary to the best principles of sanitary science to make the charge for sewerage higher than its actual cost, and the city should not count upon making a profit over actual cost. The error in principle in most sewer and other franchises is

just here. Services to all the people should be furnished at as nearly actual cost to them as possible. This is especially true of sewer franchises.

Some Glasgow Methods. Some officials of the city of Glasgow, Scotland, in reply to inquiries, have given quite full statements of methods and results in that city, from which the following are extracted:

The water supply from Loch Katrine is pure and soft and abundant. The aqueduct delivers 45,000,000 gallons a day, and a new aqueduct, now under construction, will increase the delivery to 80,000,000 gallons a day. The Gorbal works supply an additional 4,000,000 gallons. The population is now estimated at nearly 1,000,000. The price of water is 6d. on the pound of rental value. Thus an artisan's house of 12 pounds ($60) rental value would pay 6s. ($1.50) a year. The city owns the works.

The city owns the gas works, has reduced the price per 1,000 cubic feet since the works were purchased from 4s. 7d. ($1.17) to 2s. 2d. (54 cents), and recommends a further reduction for the next year of 4 cents, the gross revenue being 605,794 pounds and the gross expenditures 472,844 pounds.

The city electric light works had a gross revenue of 25,862 pounds, and gross expenditure of 11,589 pounds.

The street car system is now horse power, but will shortly be transformed into the overhead electric trolley system. The fares are graduated from one-half penny for an average distance of about one-half mile to 3 pence for an average distance of about five and one-third miles. The present system pays all expenses, interest, sinking fund, depreciation, renewal and reserve funds and 9,000 pounds annually to the general city funds. The city received about 2,800 pounds from the companies before the city purchased the system. Numerous additions were made to the facilities during the last year, resulting in a net increase in capital account of about 40,000 pounds.

The wages of boys per week range from 7s. to 12s. and of men from 21s. to 27s. for sixty hours' work.

These figures show the possibilities of municipal control of the natural monopolies when the question of politics is kept in the background and municipal affairs are conducted on a business basis. The city council consists of seventy-seven members, serving without pay, from whom are elected the lord provost, fourteen city magistrates, two bailies of the port and river, a city treasurer and master of works. It is an honor to belong to the council, and re-elections after terms of three years' length are frequent.

CURRENT INFORMATION.

STREET CLEANING IN WASHINGTON.

Dissatisfaction with the method of street sweeping in Washington, D. C., led the Board of Commissioners to send Engineer Commissioner Black to New York City to investigate the system in that city. The commissioners of the District advertised for proposals May 22 for cleaning the streets under four propositions. Of these propositions three contemplated machine methods, and one hand work. The bids received for hand work seemed very low, but the commissioners decided to make a thorough investigation before adopting that method. The appropriation for street sweeping is about $90,000. The old contract expired June 30. The merchants and the laboring classes urge the hand method. Commissioner Black called upon Col. Waring, who advised him to continue street cleaning by machinery until in a position to adopt the hand plan and put it in operation upon a thorough basis; that to try to sweep the streets of Washington by hand, under such a small appropriation, would inevitably result in failure, thereby giving hand-sweeping a setback from which it will not recover. A bill is now pending in congress which, if enacted, will give the commissioners authority to do the work.

IRREGULAR METHODS OF CONTRACTING.

The committee of the Pennsylvania State Senate appointed to investigate municipal affairs in Philadelphia has reported the discovery that strict compliance with the specifications for Belgian block paving would mean a cost of between $5 and $6 a square yard to the contractors, and yet the average price paid by the city is $3.50. The conclusion of the committee is that requirements of the specifications are deliberately violated. It is not denied that the city may be getting a fair return for the price it pays, but the point is that the contract requirements are not met. The committee points out mischievous possibilities as follows:

"Naturally, a system under which the contractor contracts to do work of a defined kind for a price much less than the work was actually worth, and then performs only so much of it as is actually required of him by the official in charge, leads to the result that these contracts will only be taken by men who understand that they will not be required to do that which they contract to do. One consequence of this is that it frequently happens that there is no really competitive bidding. Another and inevitable consequence is that it restricts to but a few persons and firms the bidding and contracting for the very large amount of work annually required upon the streets of Philadelphia—in point of fact, about eight persons, firms and companies do substantially all the paving, repaving and repairing of the streets of Philadelphia."

A Philadelphia newspaper in commenting on the committee's report pertinently suggests that irregular practices of this sort make difficult and uncertain a comparison of prices of work in different places, as, for instance, if in two towns where the paving specifications are the same, one has its work done in strict compliance with them and the other accepts work much less thorough, there can be no correct basis of comparison between the two. And, further, the contractor who bids in good faith on meeting the requirements of the specifications will necessarily ask prices much above those of a bidder who understands that he is not to comply with the contract.

THE MODEL SYSTEM OF BOOKKEEPING FOR WATER WORKS COMPANIES.

The fifth article in the series on the model system of bookkeeping for water works companies will appear in the August number of Municipal Engineering. The space required for the report of the Denver convention of the American Water Works Association prevents its appearance in this number.

MR. ROSEWATER'S NEW PAVING SPECIFICATIONS.

New paving specifications have been prepared by Andrew Rosewater, city engineer at Omaha, which largely reduce the use of cement in repaving, substituting slag or broken stone therefor. The change, it is claimed, will save a considerable amount of money to property-owners. The cement dealers are making a determined fight against the proposed specifications.

HOW MODEL ROADS ARE CONSTRUCTED.

The department of agriculture is building, on College avenue, New Brunswick, N. J., the first of several model roads which the government is to construct at the various experiment stations throughout the country. The government furnishes a rock crusher, screen, engine to drive steam roller, spreading wagon and road grading machine and two skilled operators, and the city furnishes the material, carts and laborers. The road will be on the order of a macadam road and will have a depth of about nine inches. The roadbed will be prepared by being thoroughly rolled with a ten-ton steam road roller, four inches of crushed stone, varying in

size from a half-inch to two inches in diameter, and will then be laid on the roadbed; over this is spread a second layer of stone three inches in thickness; a thin coat of trap rock screening will then be spread over the surface. The cost of the road will be about $2,000 a mile, which, with the government aid, will be reduced about one-third.

LEGAL OPINION REGARDING STREET PAVING IN DETROIT.

Corporation Counsel Flowers of Detroit, Mich., has given the opinion that the common council is the only body which has the right to name the kind of material to be used in paving a street; that it has the power to direct the board of public works to advertise for proposals for paving streets with such materials as it may deem proper, providing the same is embraced in the specifications prepared by the board of public works and approved by the council; no money other than that appropriated can be used for repaving any street. The board of estimates having agreed upon the amount of money to be used for repaving certain streets, the amount designated for one particular street becomes a separate fund for that street alone, and the council cannot direct that a part of the street be paved and appropriate the money set aside for the payment of the contract price for the part. "If such a proceeding were lawful," Mr. Flowers says, "it would be in the power of the common council to curtail improvements from year to year. It would be a very ingenious and dangerous method of violating not only the spirit, but the clear language of the law."

DECISION AFFECTING PURCHASE OF WATER WORKS IN MONTANA.

The Supreme Court of Montana, in an opinion filed June 7 by Chief Justice Pemberton, decided that the section of the political code making it mandatory upon municipalities to purchase existing water works before they could first maintain systems of their own was unconstitutional and without effect. The decision was rendered on an appeal by the city of Helena from a ruling of Judge Henry N. Blake, rendered about one year ago. By a special election held in 1895, the city council was authorized to extend the limit of its indebtedness for the purpose of procuring a water supply. The city andthe Helena Consolidated Water Company had been divided in opinion for some time as to the rates the city should pay for water used by it. The old contract had expired and the cly refused to renew it or to agree to another on the terms of the water company. During the contention between the city and the company the city continued to use the water furnished by the company, and the latter brought action to cover the amount alleged by it to be due for the service. That suit is still pending. After an election on the question of extending the indebtedness, which resulted favorably, the city advertised for bids for a water system. The water company asked for an injunction restraining the city from buying a plant without first purchasing the existing plant, and Judge Baker granted a temporary restraining order pending the agreement of the question. The judgment was reversed in the supreme court and the cause remanded with directions to dissolve the injunction.

INQUIRIES REGARDING STREET PAVING.

The joint standing committee on streets, at Willimantic, Conn., has received 134 responses from letters of inquiry sent to the officials of 200 cities in the United States regarding street paving. In its report, submitted June 4, the committee claims that its investigations have convinced it that the chief cause of destruction to street pavements is the frequency with which they are dug up for repairs and for the laying of underground pipes.

ASPHALT PAVING IN PHILADELPHIA RESTRAINED.

In an opinion rendered by Judge Pennypacker June 9, in the asphalt paving suit brought by Henry C. Carroll against the city of Philadelphia and others, an injunction restraining the city from executing certain asphalt paving contracts was granted. The charge was made that the word "lake" was fraudulently inserted in the ordinance during its progress through the councils. Judge Pennypacker finds that the allegation of fraud was not supported by the testimony, but that the director of public works, without intentional fault, exceeded his powers in the wording of the specifications, which made it possible for certain contractors to bid successfully. After reviewing at length evidence as to whether there was such an article known to commerce as "lake asphalt," and after describing the supposed different qualities of lake and land asphalt, the court decided that the term is properly used and that councils had full power to require the use of such an asphalt if they deemed it best for paving, but the specification is at fault because it does not describe a fixed standard, for the testimony of Mr. Clifford Anderson and others showed that Trinidad lake and Bermudez

lake vary widely in the per cent. of bitumen they contain, and when the two are specified as the same it is equivalent to "setting up a standard with a double head." The court adds: "If the standard of Trinidad asphalt were fixed, and if the standard of Bermudez asphalt were fixed, and if the specifications had requested bids for material equal to the Trinidad standard, and also other bids equal to the Bermudez standard, that would call for a system of alternative bidding which under some circumstances might have advantages."

By the decision thirty-two asphalt paving contracts are declared void. A precipe was issued June 14 by Chief Justice Sterrett, and the entire case will be carried to the supreme court.

BONDS OF CITY OFFICERS.

The new city charter of New Haven, Conn., provides that no person shall give bond for the faithful performance of the duties of any city officer, but that all bonds shall be given by some suitable surety corporation. Bond for nearly all of the city officers is now furnished by some personal friend. By the new charter all chiefs of departments are made superintendents. It provides also that no public improvement of any kind shall be ordered by the court of common council or other authority having power to authorize the same until an appropriation for said improvement has been duly made.

STREET PAVING IN ILLINOIS TOWNS.

The bill passed recently by the Illinois State leigslature, which provides that in cities having less than 25,000 people at the time the last census was taken no public improvements shall be made without the consent of a majority of the owners of the property abutting upon the street concerned, goes into effect July 1.

SANITARY PAVEMENTS AND STREET CLEANING.

The Pathological Society of Rochester, N. Y., which has been giving its attention to the question of sanitation in the construction and cleaning of pavements, has unanimously adopted a report submitted by the committee on street improvement, June 3, in which it expresses the conviction that no pavement should be used which does not prevent the infiltration and contamination of the soil; that only asphalt, brick or stone, laid over cement or concrete foundation, with water-tight gutters and lateral sewers, afford protection against contamination of the soil by decomposing organic matter; that the frequent cleaning of unimproved and macadamized streets is as necessary and desirable as that of improved streets; that the method of cleaning by constant manual sweeping and gathering of accumulated dirt and refuse in bags, is the most sanitary; that the ordinance against the littering of streets with ashes, garbage, etc., should be enforced, and that the executive board and city engineer be requested to use their influence to discourage plans for street improvement which do not provide for perfect sanitary conditions.

VERDICT AGAINST CONTRACTORS IN DES MOINES.

Judge Holmes, of the district court, has rendered a decision in the case of E. R. Mason and William Foster against the city of Des Moines, Ia., the board of public works, mayor, city clerk and Stein & Sons in the Grand avenue curbing injunction suit. The suit is the result of a contract which Stein & Sons had for laying 9,000 feet of curbing, which the property-owners objected to paying for, claiming that there was fraud in the performance of the contract in that the specification called for only three parts in ten of sand, and that six parts were used. All of the property-owners paid for the work, however, except Foster and Mason. The court decides in favor of the plaintiffs, and sustains the charge of fraud in the performance of the contract and collusion on the part of the board of public works in permitting fraud and accepting the work.

LIFE ON THE ISLAND OF TRINIDAD.

E. J. Lindsay, an American traveler from Milwaukee, some months ago visited the island of Trinidad while on a South American tour, and spent a couple of hours there. In an interview with a reporter of the Milwaukee Wisconsin he described Pitch lake and how asphalt is taken from it. Readers of Municipal Engineering are familiar with the geographical and technical facts regarding this subject, but Mr. Lindsay's observations as to some of the hardships of life there are interesting. "It has been stated," he says, "that no white man remains at this place for any length of time. That is practically true, as the superintendent in charge, who is, of course, a white man and an American, is changed about every year, or in a shorter time, for his own sake. A fine house, completely and elegantly furnished, stands at the end of the pier, out over the sea, a quarter of a mile from shore, in which the superintendent resides during his term on La Brea. He has as many servants as he needs and all the comforts possible, but the life is so monotonous that he is always delighted when his term is up and he is superseded—one of the rare incidents where a business man having a good

thing is glad to be displaced by a successor. With the exception of an assistant and the foremen, there are no whites about the asphalt plant who remain long. The Milwaukee party remained about two hours, with the February temperature 100 in the shade, and notwithstanding their great interest in the scene, they were glad when the time for departure arrived. A large number of small houses, huts, etc., are scattered about the place for the use of the natives employed on the work, but with the exceptions noted, La Brea is as barren of humanity as the desert of Sahara, with little more in the way of natural comforts.

"During our trip I selected 100 views taken by a professional photographer who was a member of the party, but I do not believe any of the views of the interesting and wonderful places, people and things photographed on the entire trip are equal in interest to the excellent picture of the great asphalt lake and its surroundings," remarked Mr. Lindsay. "The lake is situated on a plateau, back about three-quarters of a mile from the sea. The great buckets on the cable line are carried up and down by the force of gravity, the loaded buckets on the descent being sufficiently heavy to carry the empty ones up the incline to the lake, after they have deposited their cargoes in the vessel, and in this way the buckets go up and down in endless-chain style, dumping their loads into vessels in waiting as rapidly as coal is unloaded from one of the vessels here by a system of cables and buckets. The quantities of asphalt supplied are simply regulated by the demand, and vessels can be loaded and sent forward as rapidly as they put in an appearance. During our stay of two hours there were two great vessels from European ports at the end of the pier receiving cargoes, and we were told that ships from almost every port in the world go there for this article of commerce —the only thing of use or value to be found there. There are no regular passenger steamers stopping at La Brea, as comparatively few people, it seems, care to brave the intense heat and the general barren monotony of the country; those who do go make special arrangements for the trip. When we were there the superintendent of the works, who was a bright young man from Massachusetts, and a graduate of Harvard, was anxiously awaiting the arrival of his successor in office, in order that he might return to civilization after a sojourn at the place of about a year. I was informed that no superintendent desires to endure it longer than a year, and many are relieved at the end of six months. The place is of the greatest interest to the tourist, but I do not wonder that no white man cares to remain there long, even as boss of the place at advanced wages. It is the most forlorn waste of monotony, and at the same time one of the most interesting places, I have ever seen or heard of."

NEW INSULATION FOR ELECTRIC CURRENTS.

Considerable interest is excited in the East concerning the insulation of electrical currents by a new method, which is one of the most important problems in municipal engineering, when we consider the electrolysis of pipes and the fires and other injury done by escaping electricity. This has been by the discovery that powdered silica properly applied or packed about electric conductors will insulate the current. The material should be as near a silicon di-oxide, SiO_2, as possible. This material, which is so easily obtainable, seems to make it possible to put large insulators about the rods and wires, whereas the expense of rubber and its imitations or substitutes has heretofore often caused insulation to be lighter or poorer than it should really have been. The method of using the very finely crushed or powdered silica is to have the copper conductors imbedded in the material and the whole surrounded by a soft iron or other metal pipe, which permits the whole to be bent or conformed to whatever position is necessary. The experiments, which a member of our staff has recently watched, in company with others, have been successfully conducted with wires imbedded in the tubes from three-eighths of an inch in diameter and upward.

This powdered silex of silica seems to be non-hygroscopic. If this property of not taking in moisture from the atmosphere be fully established it will result in a method of imbedding electrical conductors carrying very strong currents in such a way as to protect all surrounding parts from injury, as well as preserving much of the current too often lost.

MUNICIPAL REPORTS.

Annual Report of the Board of Street and Water Commissioners of the City of Newark, N. J., for the year ending December 31, 1896.

This volume embraces the reports of M. R. Sherrerd, engineer of the department of water; J. Crowell Mundy, general superintendent of works, and Ernest Adam, engineer of the department of streets and sewers, and includes much statistical information regarding the work of the various departments. Some of the difficulties encountered in connection with the water supply of Newark are explained by Mr. Sherrerd. The contract for new water supply limited the consumption to 27,500,000 gallons per day, which was 2,500,000 less than occasional requirements. Experiments had demonstrated that additional supply could be obtained from underground stratas, in the basins on each side of the pump house and in driven wells. By a simple arrangement this water was pumped into the basins and afforded a supply sufficient to meet any deficiencies. Only once last year was it found necessary to take water from the Passaic river. This

was caused by an interruption of the supply from the watershed, due to clogging of the screens at Macopin intake early in March by "anchor ice." It is thought that this trouble can be avoided in the future by changes in the arrangement of feed at the gate house and by alarm gauges connected with floats both inside and outside the screens, which will give immediate notice of the slightest interference to the flow. The revenues increased $58,116.93 over the previous year and the disbursements $48,076.35.

Mr. Mundy says that with six new sweeping machines he was enabled to keep the streets cleaner than formerly and at less expense. Mr. Adam's report shows that the expenditures for new paving were $678,679, of which $404,117 was for asphalt, $74,154 for brick, $185,006 for granite and $5,491 for telford. The average prices per square yard were as follows: Asphalt, 6-in. concrete base, 1½-in. binder and 2-in. surfacing, $2.583; brick, 6-in. concrete, 1½ sand cushion, tar filler, $2.29, with cement filler, $2.15, and with sand filler, $2.14; granite, 6-in. concrete and 2-in. sand filler, $2.18. New sewers, 1,097 feet of brick and 26,879 feet of pipe, with 155 manholes and 40 catch basins, cost $30,544, with $2,712.50 additional for inspection.

Mayor's Message, City Comptroller's Report and Reports of the Departments of the City of Williamsport, Pa., for the year 1896;

The most important of these reports is that of Mr. George D. Snyder, city engineer, which was reviewed in the Februray number of Municipal Engineering.

Annual Reports of the Mayor and Heads of the Departments of the City of Hastings, Neb., for the year ending April 1, 1897.

Some of these reports mark the beginning of an annual review of official affairs in Hastings, notably that of the water commissioner, L. A. Kinney, who says that he finds that no complete records had been kept and that much valuable information of former years was missing, and in consequence comparisons cannot be made to determine how well the department has been managed. Mr. Kinney calls attention to various deficiencies in the water works. The pumping facilities are inadequate and the mains are too small, involving unnecessary fuel expense for pumping, and resulting in such low pressure during the sprinkling season that consumers can get only half supply, besides greatly increasing the fire risk. The use of meters is recommended to stop lavish waste of water.

Pasadena Municipal Reports for the year ending Februray 28, 1897.

The reports of W. B. Clapp, city engineer, and J. A. Buchanan, superintendent of streets, show a total expenditure on street and sidewalk paving, curbing and sewers of $64,156. Mr. Buchanan recommends a coating of cement and sand mortar for cobblestone gutters, and in the future the use of concrete instead of cobblestones in the paving of gutters. The city regularly sprinkles forty-eight miles of streets.

Official Report of the City of Perth Amboy, N. J., for the year ending March 1, 1897.

Superintendent Eggert of the water department complains of waste of water and recommends that financial provision be made for introducing the use of meters, the cost of which he estimates at about $12,000. He also advises the purchase of a new pumping plant.

NEW PUBLICATIONS.

"Mechanics of Ventilation." Geo. W. Rafter. 143 pp. 50 cents. D. Van Nostrand & Co., New York.

This revised edition of a little manual for instruction of students in the mechanics of ventilation is the outgrowth of some special studies by the author and gives an outline of some of the principles of the subject. Full discussion must be looked for in larger treatises ,but a very good idea of some of the problems to be solved and of methods of discussing them can be obtained here with little expenditure of money for the book or time in reading it. The book is a worthy member of the Van Nostrand Science Series.

"The Microscopical Examination of Potable Water," Geo. W. Rafter. 160 pp. 50 cents. D. Van Nostrand & Co., New York.

Another number in the science series gives Mr. Rafter's development of Mr. Sedgwick's method of making quantitative determinations of the amount of microscopic life in potable water. The method presupposes familiarity with the organisms found in the water and is a description of a practicable method of concentrating the organisms and arranging them for counting so that the actual numbers of each in a given quantity of water can be approximately determined. The book contains some typical results of examinations and is interesting to any scientific student, but is of special value to the student of quantitative methods of analysis.

Report of the Provincial Instructor in Road Making for Ontario. Printed by order of the Legislative Assembly of Ontario.

This report, prepared by A. W. Campbell, provincial instructor in road making for Ontario, is a thorough treatise of the subject. It shows the condition of Ontario roads in general; it demonstrates the needs of improvement and shows clearly and correctly

the best methods for doing the work in detail. In no respect is the subject slighted. It is an excellent official document.

Hugh Murphy vs. City of Denver. Col. 188 pp.

This volume is a review of the testimony in the litigation between Hugh Murphy and the city of Denver regarding the award of paving contracts in which he has been interested as a bidding contractor. It contains in addition many letters and newspaper extracts on the subject of asphalt paving.

"Car Sanitation." By A. L. Elcan, M. D., of Memphis, Tenn. Report of the Committee on Railway and Steamboat Hygiene of the Tennessee State Board of Health.

The Technic. Annual Publication of the University of Michigan Engineering Society, Ann Arbor, Mich.

Municipal Affairs. No. 2 of the quarterly publication issued by the Committee on Municipal Administration of the Reform Club, No. 52 William St., New York. Price, 25 cents.

PERSONAL.

E. J. Noonan has been appointed city engineer at La Salle, Ill.

George Hornung of Bellevue, Ky., has been elected superintendent of the Newport water works, John Surran was elected vice-president, Elmer Kirker, secretary, and Charles Biltz, assistant secretary.

Joseph Sexton has been elected president of the Saticoy water company at Ventura, Cal., with R. C. Sudden, vice-president, J. S. Collins, treasurer, and B. W. Dudley, secretary.

James Allen Morris succeeds Mayor John A. Fitten as a member of the city water board at Atlanta, Ga.

Harry Van Newkirk, general superintendent of the Bermudez Asphalt Paving Company, died at his home in Chicago, June 2.

Hugh Doran has been re-elected sunperintendent, Lewis Atkins, secretary, and William H. Avery, chief engineer of the water board at Port Huron, Mich.

L. J. Schroeder has been appointed superintendent of water works at Dundee, Ill.

Charles W. Andrews has been appointed superintendent, I. J. Bryan, secretary, and Robert M. Orr, treasurer, of Lincoln Park at Chicago, Ill.

W. F. Robbins has been elected superintendent of water works at Piqua, O.

Dr. Jason T. Wallace has been appointed sewer commissioner at Oneida, N. Y.

Harvey A. Bourne has been re-elected superintendent of water works at Manchester, Va.

William H. V. Reimer has been appointed township engineer and superintendent of streets at East Orange, N. J.

A. B. Raymond succeeds George Y. Wisner as sanitary engineer to the board of health at Detroit, Mich.

George D. Norman has been elected water and sewer commissioner for five years and Frank L. Moran for four years at Watkins, N. Y.

J. G. Voss has been elected superintendent of the water works and electric light plant at Newbury, S. C.

Henry N. Ogden, city engineer at Ithaca, N. Y., contemplates a visit to England this summer, and while there will examine the various sewage disposal plants.

R. Walter Crenzbauer, Assoc. M. Am. Soc. C. E., has been appointed assistant engineer in charge of the water purveyor's bureau of the department of public works, New York City.

Donald W. Campbell, C. E., has been appointed chief engineer of the board of public works at Denver, Col. William H. Taylor has beeen appointed secretary of the board and William T. Davoran commissioner of highwavs

C. M. Howard has been elected water comissioner at Randolph, Vt.

William Stone, William Voss and John Habhegger have been elected water commissioners at Watertown, Wis.

D. B. Bayless has been re-elected president of the water works commission at Covington. Ky., for a term of three years.

R. H. Engle and J. A. Stewart have been engaged as assistant engineers in the construction of the new water works at Cincinnati, O.

Frank Hauck has been appointed superintendent of the water works, to succeed C. C. Bingaman, at Allentown, Pa.

City engineers have been elected as follows: W. H. Norton, Earlville, Ill.; John C. Quade, Kewanee, Ill.; C. E. Widener, Cumberland, Md.; Frank Cooper, Fairmont, W. Va.; F. E. Josel, Freeport, Ill.; Andrew Rosewater, Omaha, Neb.; Thomas McGilroray, Duluth, Minn.; E. P. Dickey, Warren, O.; Julian Griggs, Columbus, O.; John Davis, Newton, Ia.

Stevenson Towle, consulting engineer, New York City, has resumed the practice of civil engineering and surveying.

George D. Talbot has succeeded George Preble as secretary to Highway Commissioner Davoren, at Denver, Col., the change to take place July 1.

Prof. E. G. Smith, professor of bacteriology in the Beloit, Wis., college, delievered a lecture before a sub-committee of councils' water commission, at Philadelphia, Pa., June 15, explaining the necessity of a system of filtration to purify the city's water supply and the advantages of the system of sand filtration.

MACHINERY AND TRADE.

A NEW STREET FLUSHER.

The Kansas City department of public works has designed a new street flusher. The carriage is built of three and one-half inch wrought iron pipe. The whole frame work is hollow, and hose may be attached at either end. In flushing a street the forward end is driven close to a fire plug, and fifty feet of hose is paid out. When an area has been flushed as far as the hose will reach the wagon is driven forward its length—eighty feet—and the hose attached to the rear end. Two men operate it, and the trucks are steered by tillers, similar to the big hook and ladder truck at fire headquarters. When the machine is moving straight forward the rear tiller is locked, and the tillerman manipulates the nozzle on the forward platform. The horses are hitched to the machine just in the rear of the forward trucks with a tiller, the same as that on the rear trucks. It is asserted that thirty blocks of pavement can be flushed with the machine with the same time and cost now used in flushing eighteen blocks.

TRADE NOTES.

Franklin, Conn., has voted to purchase a new road machine.

The White Cliffs Portland Cement Co., White Cliffs, Ark., has been reorganized.

The St. Joseph County Sewer and Paving company, South Bend, Ind., has been incorporated.

The purchase of a sprinkling wagon is contemplated at Sharon, Mass.

The California Asphalt Co., Pittsburg, Pa., has been formed by James Booth and William Flinn.

The purchase of a stone crusher was decided upon, June 1, by the council at Exeter, Pa.

The purchase of a steam road roller is contemplated at Niles, O. J. L. McDermott, city clerk.

The town council, Cumberland, R. I., contemplates the purchase of a steam road roller. Andrew J. Currier interested.

The purchase of a stone crusher, at a cost not to exceed $600, has been authorized at Wilmington, Del. Mayor Wright.

Great Barrington, Mass., has purchased a steam road roller of the Pitts Agricultural Works, Buffalo, N. Y., at a cost of $2,500.

The Somerset Stone Crushing Co., Bernardsville, N. J., has been incorporated by F. S. Tamtor, J. Stursburg and A. W. Post.

Knowles, Taylor & Anderson contemplate enlarging their sewer pipe factory, at East Liverpool, O., to twice its present capacity.

The purchase of a steam stone crusher, at a cost not to exceed $1,000, is contemplated by the committee on public works, at Deering, Me.

A tract of land of 140 acres, on the side of Mount Manitoe, in Granby, Mass., has been leased by W. P. Fuller and W. C. Pease of Somers, Conn., and F. P. Squier of Westfield, who will open a trap rock industry.

About eighty feet of kiln sheds belonging to the Galesburg Paving Brick Co., Galesburg, Ill., burned recently, entailing a loss of about $500.

The sewer pipe works of Reichert & Co., Appleton, Wis., have been purchased by John Driscoll, who will put them in operation at once.

The Western Clay Manufacturing Co. has been organized at Salem, Ore., to manufacture sewer pipe, drain tile, brick, terra cotta and fire-proofing.

The Coffeyville Brick Co., Coffeyville, Kas., secured the contract for furnishing 1,700,000 paving brick for paving the streets of Shreveport, La.

The new plant of the Nelsonville Sewer Pipe company, Nelsonville, O., which was built to replace the one burned in December, has been completed.

Aldermen Denny, Link and Stedman were appointed a committee, June 5, at Peru, Ill., to inquire into the cost of a steam road roller and a stone crusher.

The Philadelphia Mortgage & Trust Co. asked recently for the appointment of a receiver for the Vitrified Paving & Pressed Brick Co., of Lincoln, Neb.

The East Field Road company, Pangnitch, Utah, has been organized to construct and keep in repair a wagon road near Pangnitch. John F. Chidestee, James A. Worthen and others are interested.

The purchase of a rock crusher and road roller is contemplated, according to report, at Maquoketa, Ia. C. M. Sanborn, mayor; R. S. Mann, William Gibson, E. P. Hatfield, commissioners of streets.

The F. D. Cummer & Son Co., of Cleveland, Ohio, reports the sale of one of its dryers to be shipped to St. Petersburg, Russia, and three to Antwerp, Belgium.

The directors for the first year for the recently incorporated asphaltina company, of Syracuse, N. Y., are Henry M. Hurhaus, Ransom B. True, Henry J. Stevens and William J. Gillett.

Sealed proposals will be received until July 6 for furnishing riprap stone, broken stone, sand, pebbles and American natural cement. Chas. J. Allen, Lieut.-Col. Engineers, Washington, D. C.

T. W. Ossfield, of Clearmont, Ia., contemplates the manufacture of building brick, tile and paving brick, from clay located a short distance from Lester Park, Duluth, Minn.

The East St. Louis Bridge & Construction Co. has been incorporated at Belleville, Ill., by H. D. Sexton, George Schaub and John Niemes, to erect and maintain a bridge over the Mississippi river between St. Louis and East St. Louis.

The Board of Trade, of Foxboro, Mass., gave a banquet, May 28, to the Board of Trade of Mansfield, to discuss the feasibility of Foxboro purchasing a steam road roller to be used in conjunction with the stone crusher by the town of Mansfield.

The Berlin Water Company has been organized at Portland, Me., for the purpose of manufacturing machines, fixtures and apparatus for water works, operate water works and supply manufacturers with water. The officers of the company are: President, Daniel J. Daly, Berlin, N. H.; treasurer, H. I. Goss, Berlin.

The plant of the Iowa Pipe and Tile company, Des Moines, Ia., which was destroyed

recently by fire, has been rebuilt, and consists of three main brick buildings, 190x90 feet each, and three-stories high; one 50x60 feet and one two-story building 40x90 feet. The machinery is all modern.

The Massachusetts State Highway Commission notified the county commissioners recently that an appropriation of $12,000 had been made by the legislature for the purchase of steam road rollers, stone crushers and other road machinery, and that all assignment of machinery to the different towns and counties must be filed before June 10, 1897.

The purchase of a road roller and rock crushing plant is contemplated at Danville, Ga. C. A. Ballou, City Engineer.

The National Improvement Construction company has organized, with principal offices in Camden, N. J., to construct sewers, water works, railroads, etc., by Michael W. O'Boyle and John H. Foy of Pittston, Pa., and Edward R. Sprigman of Woodbury, N. J.

The California Asphalt company is making rapid progress in the construction of its plant in Ventura, Cal. The necessary buildings are being erected very rapidly, and in a very substantial manner.

W. L. Bishop, superintendent of streets at Dartmouth, Nova Scotia, reports that during June an average of 65 tons of stone per day were crusned by the stone breaker operated by him. This was done by two men, whose wages amounted to $2.35. Two teams which hauled the stone one-third of a mile cost $4.00, one man who spread the stone, $1.10. The cost of the 65 tons of stone was $16.25, and breaking $7.45, making a total of $27.30.

SELECTIONS FROM THE PRESS.

TARIFF ON IMPORTED CEMENT.

The American Association of Portland Cement Manufacturers recently held a meeting in New York, and appointed a committee to go to Washington and protest against the proposed increase in the duty on cement. Under the present law the duty is 32 cents a barrel, and at that rate the government collects nearly $1,000,000 a year from importations, while the American manufacturers, who can sell cement at a satisfactory profit at from 25 to 50 cents a barrel less than the cost of the imported cement, and who are gradually bringing their product to a very high standard, are quite contented with the existing conditions. Both Mr. Dingley's and Senator Aldrich's committees left the duty unchanged, but an amendment introduced by Senator Quay and passed by the senate raises it to 40 cents a barrel. No one seems to understand why a change was made, for a representative of the American manufacturers appeared before the Dingley committee to say they were satisfied with the present rate. Although a difference of 5 or 6 per cent. in the cost of Portland cement does not count for very much in building work, it seems altogether probable that the American manufacturers are prudent in opposing any material increase in the duty, which would lead to bringing fresh capital into the business. The history of the iron manufacture in this country shows how the profits due to high protection, intensified by combination, attract capital, until the monopoly breaks down by its own weight, and a scramble for a market ensues which carries prices almost as far below a reasonable standard as they had been forced above it.—American Architect.

MAKING A CITY.

The movement toward improving the general appearance of our streets, by keeping lawns, boulevards and other grass plots in order, is a healthy sign of active public spirit. That our people should look upon the city as their home and not as a mere temporary roosting place, a sort of Arab's camp, is the first essential to united action for the good of the city. There is no better way of stimulating and employing that kind of public spirit than in bettering the external appearance of things.

While we are planning boulevards to display to the sight-seeing stranger we must not forget that a city is judged more by what it is silent about than what it boasts of. A street impassable for mud or a rotten, worn-out, superannuated paving will offset the good effect produced by miles of asphalt. The prospector looking for a place to settle will take into consideration the bad spots as well as the beauty spots. Making a few selected streets a paradise, while the rest of the city is as neglected as a series of cow paths is surely the very worst policy.—St. Paul (Minn.) Dispatch.

HEALTHFULNESS OF ASPHALT PAVEMENTS.

It is now claimed that lowered mortality may be due to the increased area of asphalt pavements. These, it is thought, prevent the saturation and pollution of the earth beneath by the fluid portions of decomposing substances in the streets. Ground air has long been held accountable for much that was otherwise inexplainable in the mysterious development of some diseases and furnishes a strong probability in favor of this new theory.—Popular Science News.

LEGAL DECISIONS.

[Reported specially for MUNICIPAL ENGINEERING.]

Liability of Bidder for Failure to Execute Bond—A bidder to whom a city contract is awarded, who wrongfully refuses to execute a contract and bond submitted to him incurs a liability for which the city may appropriate money deposited by him on making his bid, where the loss to the city from his refusal to comply with the contract exceeds the amount of such deposit. But where his bid is conditioned on the city paying monthly the entire cost as it is completed and accepted, he cannot be required to accept a contract where only a portion of such amount is to be paid monthly.—Cotter vs. Casteel, 37 Southwestern Rep. 791.

Damages for Breach of Contract—The measure of damages for breach of a contract to take crushed rock at a specified price is the difference between the contract price and what it would have cost the seller to furnish the material. Am. Bridge & C. Co. vs. Bullen Bridge Co., 46 Pacific Rep. 138.

Proper Elements of Damage to Contractor—The loss sustained by a sewer contractor from being obliged to surrender a contract for the purchase of brick owing to the unlawful suspension of the work by the city and the subsequent purchase of brick at an increased price, and the increase in wages which he was compelled to pay owing to the same cause are the proximate result of such suspension and proper elements of his damage. King vs. Des Moines (Sup. Ct. Ia.) 68 Northwestern Rep. 708.

Certificates Not a Condition Precedent—A certificate of completion required by a contract for public works as a condition of the payment of the contract price is not a condition precedent to an action on the contract before its completion, based on the suspension of the work by the city in violation of the terms of the contract. French vs. Syracuse (Sup'r Ct.) 17 Misc. Rep. 378.

Recovery of Illegal Assessment—Payment of an illegal street improvement assessment, after the commencement of active legal proceedings for its collection by the sale of the land is not voluntary and may be recovered back in a proper action. Poth vs. New York, 151 N. Y. Rep. 16.

What Is Not an Illegal Contract—An agreement for the division of profits upon a public contract is not invalidated by the fact that the parties agreed that the bid for such contract should be made for their joint benefit, and one of them, with the knowledge of the other, made a bid much higher without intending that the contract should be awarded, where such bid did not in effect influence the action of the public authorities in awarding the contract. McMullen vs. Hoffman (U. S. Cir. Ct.) 75 Federal Rep. 547.

What Cannot Be Done by City—An agreement by a bidder for a contract for certain work on the streets of a city to do such work under the direction and to the satisfaction of the board of public works does not authorize the city at the instance of such board to oust the contractor from the street and seize and hold his property found on the streets until he shall comply with the demand of the city to remedy a claimed deficiency in the number of workmen or quantity of implements employed in the prosecution of the work, or to hold back money due or to become due the contractor as security against imaginary damages which may result to the city from suits for labor performed on the improvement. Cotter vs. Casteel (Tex.) 37 S. D. Rep. 791.

Conclusion of Engineers Not Binding—Engineers appointed to determine any question that may arise in regard to the performance of a contract for public work, or in regard to the mode of doing the work while it is going on, cannot bind the town by a construction of the contract not justified by its terms. Braney vs. Millbury (Mass.) 44 N. E. Rep. 1060.

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Council Bluffs, Ia.—The wide tire ordinance goes into effect July 1.

The city of Glasgow, Scotland, has contracted to pave several blocks of streets with California asphalt.

Houston, Tex.—(Special.)—M. H. McLaurin, representing the Burnet Granite Co., is urging this city to use crushed granite macadam on some of its roadways.

New York, N. Y.—(Special.)—Cork bricks will probably be used in the driveway and entrance court of the Astoria hotel, and in the private street at the rear of the Waldrof and Astoria hotels.

Albany, N. Y.—The board of contract and apportionment decided, June 21, to rescind its action awarding the contract for paving Upper First street with asphalt, owing to an irregularity in the council proceedings.

Peoria, Ill.—Petitions are being circulated

by the property-owners on W. Seminary and N. Acadamy streets asking for the privilege of having Bedford stone curbing admitted to competition. Only Berea sandstone is named at present in the specifications.

Niagara Falls, N. Y.—Resolutions were introduced in the common council, June 8, relative to imposing a tax upon the Rochester railway company, compelling it to help pay for new pavements on the street where tracks are laid, thus materially reducing the cost to property-owners.

Chicago, Ill.—The Bermudez Asphalt company began work on their contract for repaving with asphalt Jackson street, June 7, and think it will be completed by August 1. Governor Tanner has vetoed the Lake Front park and boulevard bill on the ground that it is unconstitutional on five points.

Buffalo, N. Y.—The committee on streets of the board of aldermen, of Buffalo, N. Y., has recommended the requirement of an increase of the guarantee on asphalt pavement from five to ten years, and also the withholding of 10 per cent. of the contract price for five years and then to pay at the rate of 2 per cent. a year.

Jacksonville, Fla.—Bisbee & Foster, according to reports, applied to the circuit court June 11, for an injunction restraining the board of public works from letting any further contracts for street paving until the present outstanding judgments against the city, which have been incurred in previous contracts, be paid.

Newark, N. J.—Mayor Seymour has asked the board of public works to admit in specifications for asphalt paving in Newark the Dun-Donald material, the supply of which is controlled by the Columbia Construction company. At present the specifications admit to competition Trinidad Pitch lake, Bermudez, Sicilian and Alcatraz asphalt.

Buffalo, N. Y.—The Barber Asphalt Paving company and the Buffalo Traction company will relieve the distress of the unemployed laborers by making two gangs in half-weekly shifts, at $1.75 a day, which will enable the men, by working three days, to earn $5.25, while the benefit to be derived from the work will be distributed among twice the number.

Chicago, Ill.—L. E. McGann, commissioner of public works, says that unless the price of the expansive metal used in asphalt paving is reduced he will strike out of the city specifications that section requiring the use of such metal. A cut was made in the price of the metal from 45 to 36 cents, but Commissioner McGann believes that there should be a further reduction of from 18 to 20 cents.

San Francisco, Cal.—Warren & Malley, street contractors, have petitioned the board of supervisors to release them from their contract for grading Montgomery avenue, between Bay and N. Point street, claiming that the property-owners will refuse to pay for the work, and as there were some irregularities in the proceedings in granting the contract they do not want to take chances in suing such payments.

Rockford, Ill.—All of the objections filed to the new asphalt pavement were overruled June 23 by Judge Bailey, who holds the ordinance passed by the council ordering the improvement to be valid and the report of the commission taxing the cost just and equitable. The Barber Asphalt Paving company of Chicago began the work of tearing up the main business streets preparatory to paving June 24.

Oakland, Cal.—Street Superintendent Miller decided recently that he could not accept the asphalt pavement laid on Eleventh street, between Broadway and Washington, owing to the adverse report of Thomas Price & Son on the analysis of the material used, and who pronounced it, as a whole, asphaltum rock melted up with the residuum left after the distillation of crude petroleum, and as far inferior to the natural bituminous rock found in many places on this coast.

Tyngsborough, Mass.—A special report submitted by the Massachusetts Highway Commission on the probable expense of constructing a state highway from the New Hampshire line to Salisburg beach, in the valley of the Merrimac river, suggests two routes through Lowell. The commissioners have made a good beginning in the construction of this road, by constructing nearly three miles in this place in 1895-6, and about a quarter of a mile in Lawrence last fall.

Jamaica, (L. I.), N. Y.—John J. McLaughlin, county engineer, has prepared a schedule of standard street and sidewalk widths, which have been adopted by the Board of Trustees. The widths of roadway between curb lines shall be 24 feet, 30 feet and 42 feet respectively for all streets having widths of 50 feet or less, 50 to 60 feet, 60 to 70 feet or more than 70 feet. Streets over 80 feet wide shall have 20-foot sidewalks.

St. Louis, Mo.—It is calculated that the contractors who are paving Delmar boulevard, between King's highway and Taylor avenue, are not complying with the specifications and are doing the work in an improper manner. Frank Koers, who has made the complaint, has deposited the sum of $100, out of which the cost of the investigation will be taken if the complaint is not well founded. Commissioners Holman and Ridgeley will conduct the investigation. The contractors are Steifel & Ruckert.

Des Moines, Ia.—The case of C. P. Dewey vs. this city, involving the legality of the awarding of the contract for paving E. Grand avenue, has been appealed to the supreme court of the United States. The plaintiff claims that the contract price amounts to confiscation of its property without compensation or due process of law. The work was done by the Des Moines Brick Manufacturing Company. McGorrisk & Co., who have the contract for paving Grand avenue, from Second street to the bridge, with brick, is using the Murphy grout filler, and if, after a reasonable time, it proves as durable as is claimed for it, it will be given a more extended trial.

Omaha, Neb.—Irregularities in the preliminary proceedings of the S. Sixteenth street repaving have been discovered which might invalidate the tax if the street were paved under the present contract, and which will probably result in the tax being abrogated and the entire proceedings repeated. Hugh Murphy has the contract. A portion of the brick pavement on L. street in South Omaha, which was laid in 1893 with only a year's guarantee, is in bad condition and will have to be repaired. The pavement was constructed of soft brick instead of vitrified

brick, but with the exception of this one portion, it shows no sign of wear.

Reading, Pa.—The specifications for asphalt paving on Penn avenue are said to be more rigid in their requirements than those of most cities, inasmuch as they require a bond of $10,000 to accompany the proposal and a bond of 40 per cent. of the price must be given for the execution of the contract; 30 per cent of the estimates shall be retained after the completion of the work for the period of guarantee; partial payments shall be made to the contractors after the expiration of the first five years; bids will be asked upon the basis of ten and fifteen year guarantees; a foundation of six inches of concrete, a one and a half-inch binder and a two-inch coating of asphalt. The sheet asphaltum must be equal in quality to Trinidad or Bermudez asphalt, but no rock asphalt of any kind shall be used in any part of the work.

Newark, N. J.—(Special.)—On June 23 the Board of Works heard the argument of J. M. Trimble, counsel of the New Jersey Asphalt Company, who submitted affidavits with a view of showing that the bid of George McDonald for asphalt pavement does not comply with the specifications of the city, which require Trinidad Lake asphalt, Sicilian, Alcatraz or Bemudez asphalts. Mr. Trimble stated that Mr. McDonald intended to use land or overflow asphalt from Trinidad. The Board of Works seems to be divided, and on political lines, as to whether or not to permit the land asphalt to compete with the four aboved named. No conclusions were reached. Meanwhile the large amount of paving ordered in that city is not begun, nor can it be until after further discussion on the subject which has arisen at intervals in other cities, but which is for the second time being considered in Newark.

New York, N. Y.—The New York World says June 23, 1897: "Gen. Collis reports that the favor with which asphalt has been received has encouraged him to substitute asphalt for all worn out granite pavement wherever his appropriations permit. There were 20.48 miles new asphalt laid in 1896, 1.89 miles of asphalt blocks and 4.65 miles of granite, a total of 27.02 miles; 1.017 miles were laid at private expense."

New York.—(Special.)—The Commissioner of Public Works gives notice that the practice of placing concrete or other friable curbs is in contravention of the ordinance of 1880, which reads "all curb stones * * * shall be of the best hard blue or gray granite," and that the department will prosecute persons setting up or making the first named curbs.

CONTEMPLATED WORK.

Reading, Pa.—Bingaman street will be paved with brick.

Clay City, Ind.—Main street will probably be macadamized.

Burlington, Ia.—Brick paving is proposed for Main street, from South to Polk.

Peru, Ill.—The city council has decided to macadamize Fourth and Jefferson streets.

Trenton, N. J.—Asphalt paving is contemplated for Center street, from Bridge to Cass.

Athens, Ga.—An ordinance has been adopted for paving College avenue, from Clayton street to Hancock avenue, with brick.

Irvington, Ind.—The National avenue will be macadamized.

Collegeville, Pa.—The bids for macadamizing the streets were rejected as being too high.

Sioux City, Ia.—Pierce street, from Second to Seventh, will be paved with asphalt.

Fitchburg, Mass.—The sum of $10,000 has been appropriated for the building of a state road.

Joplin, Mo.—Division street, from Finn to North, will be macadamized. T. W. Cunningham, Mayor.

Saginaw, Mich.—A scheme is being discussed for macadamizing Mackinaw street, from Mason to State street.

Wapakoneta, O.—Main street will be raved. Paving is petitioned for for Perry street, from Spring to Jackson.

Fon du Lac, Wis.—Vitrified brick paving with stone curbing is contemplated for Forest street.

St. Louis, Mo.—Olive street, from Grand to Vandeverter, will be paved with natural rock asphalt.

Grand Forks, N. D.—An ordinance passed first reading, June 15, providing for new paving districts.

Pawtucket, R. I.—The common council voted $5,000 for the improvement of Central avenue, June 16.

Mason City, Ia.—(Special.)—This city has decided to pave six blocks of Main street with asphalt.

Effingham, Ill.—The city council has authorized the issuance of $14,000 of bonds for paving First street.

Springfield, Mass.—The supervisors decided, June 14, to macadamize Ferry, Lombard and Elmwood streets.

Parnassus, Pa.—An ordinance has passed second reading for the issue of $10,000 for paving and sewers.

Oswego, N. Y.—Water street, between Bridge and Oneida streets, will be paved with stone on a sand foundation.

York, Pa.—Clark alley, between George and Duke streets, will probably be paved with vitrified brick or blocks.

New Haven, Conn.—Chapel street is in need of a new pavement, from State to York, a distance of 2,740 lineal feet.

Pendleton, Ind.—The council has voted to pave State street, the principal street of this city, this summer.

Kansas City Mo.—The board of public works will consider the question of asphalt as a material for sidewalks.

Mankato, Minn.—A change in the ordinance relating to the material to be used for street curbing purposes is proposed.

South Bethlehem, Pa.—This town has voted to increase its indebtedness $75,000 for macadamizing and grading streets.

New Kensington, Pa.—A special election will be held August 24, to vote on a bond issue of $20,000 for paving and sewers.

Elmira, N. Y.—The board of public works has decided to macadamize Walnut street, from Sixth street to a point not yet determined on.

New York, N. Y.—A petition is being circulated asking the commissioners of public works to pave Beaver street with asphalt.

New York, N. Y.—The department of public works has been petitioned to repave One Hundred and Twenty-fifth street with asphalt.

Newton, Ia.—A resolution was passed June 11 providing for brick paving on concrete. Bids will be advertised for soon by the city council.

Rock Island, Ill.—The city council has ordered an ordinance prepared for macadamizing Forty-fourth street.

Lafayette, Ind.—An ordinance has been adopted for paving State street, from Ninth to Kossuth, with brick on concrete, with stone curbing.

Albany, N. Y.—Brick paving is proposed for Benjamin street, from Second avenue to Porter court and Second street, from Quail to Ontario.

Rochester, N. Y.—Medina block paving is proposed for Court street, between St. Paul and Clinton streets. Edwin A. Fisher, city engineer.

Laconia, N. H.—The city council has been petitioned for concrete paving on Church street, between Hibbard bridge and Casino square.

Schenectady, N. Y.—The council has been petitioned to grade Corning street and Stanley place and curb and flag Van Vranken avenue.

Davenport, Ia.—The paving committee decided, June 14, to pave Perry street, from Twelfth to Fourteenth, with brick.

New Rochelle, N. Y.—An election will be held July 14 to vote on the question of appropriating $25,000 for grading and improving highways.

Warren, O.—A resolution was passed by the council, June 21, to secure bids on both asphalt and brick paving for Park avenue, from High to Belmont street.

Terre Haute, Ind.—A resolution was adopted, June 15, to pave Walnut street, from Second to Seventh, with brick and construct concrete sidewalks.

Youngstown, O.—Ordinances were passed, June 21, for repaving with asphalt Phelps and Haxel streets, between Federal street and the Erie railroad.

Newark, N. J.—The proposed flagging, grading and widening of Bloomfield avenue, in Verona, is being considered by the comty board of freeholders.

Grand Island, Neb.—An ordinance abolishing plank walks and recommending tiling, stone or cement sidewalks, will be introduced in the city council.

Evanston, Ill.—Ordinances were confirmed in the county court, June 16, for paving the eastern end and the central portion of Davis street.

North Adams, Mass.—Marshall street will be paved with granite blocks on a gravel foundation at an estimated cost of $12,000 to $13,000.

Pittsfield, Mass.—It has been suggested that the city make an appropriation for paving a small section of Fenn street with vitrified brick.

Bridgeport, Conn.—President Somers, of the board of public works, suggests block paving for the approaches to the E. Washington avenue bridge.

Chelsea, Mass.—Chestnut street, Crescent, Spencer, Eastern and Washington avenues will be macadamized under the special appropriation of $10,000.

Lowell, Mass.—The committee on streets voted June 14 to recommend asphaltina paving for Charles street; to pave the other half of Chelmsford street; to macadamize S. Whipple street.

Philadelphia, Pa.—The property-owners along Broadway, from Federal street to Kaighn avenue, Camden, have petitioned the city council for asphalt paving.

Kewanee, Ill.—The street and sewer committee has been authorized to engage the services of a competent engineer preparatory to doing some street paving.

Newark, N. J.—Notice of intention to pave Ann street with brick has been ordered published. Shipman street, from William to Court, will be paved with granite.

Greenfield, Ind.—Press reports state that it will only be a short time when Main and State streets will be paved with brick in the business part of this city.

Syracuse, N. Y.—Plans have been presented by the city engineer for paving University avenue, from E. Genessee street to University place, with asphalt or asphaltina.

Port Jervis, N. Y.—Trustees Wood, Purtell and Hamilton have been appointed a committee to ascertain the exact cost of paving Pike street with brick or asphalt.

Allegheny, Pa.—The councilmen are contemplating the widening of Western avenue, from the railroad bridge west to Irwin avenue, and converting it into a boulevard.

Montgomery, Ala.—The council has voted to pave with vitrified brick S. Lawrence street, from Dexter avenue to E. Jefferson Davis avenue. John H. Clisby, mayor.

East St. Louis, Ill.—The city council passed ordinances June 21 to improve the streets in nearly all of the territory west of Tenth and north of Broadway streets.

Denver, Col.—The board of public works has instructed Engineer Campbell to furnish plans and specifications for paving Eighth avenue, from Sherman to Lafayette avenues.

Sedalia, Mo.—The council passed an ordinance recently to pave Sixth street, from Lanine street to Grand avenue, with American bituminous rock asphalt. P. D. Hastain, mayor.

Pasadena, Cal.—The property-owners on S. Raymond avenue, from Colorado to Glenarm street, have asked that the street be graded, curbed and guttered with cobblestone.

Great Falls, Mont.—The council has adopted a resolution to create a special improvement district for the purpose of grading and curbing Fourth avenue. R. J. Fitzgerald, mayor.

Bellevue, Pa.—Bids will be advertised for the Lincoln avenue extension, from Grant avenue to the high bridge. Paving has been petitioned for the entire length of Jackson street.

St. Joseph, Mo.—The special committee appointed by the council recently directed the city engineer, June 5, to advertise for asphalt paving bids, according to press reports.

Moline, Ill.—Mayor Swensson has recommended that a number of streets and avenues be paved, and that the preliminary work be done at once so that it can be pushed with vigor next year.

St. Paul, Minn.—Broadway street, from Third to Seventh, will be paved as follows: From Third to Fourth with sandstone; from Fourth to Fifth with asphalt; from Third to Seventh with sandstone.

Seattle, Wash.—The city council passed resolutions, June 7, to pave First avenue, south, from Yesler way to King street, with brick and curb with granite. W. H. Chapman, president pro tem. city council.

Rochester, N. Y.—At a meeting of the council, June 8, four different ordinances were introduced for improving Jones avenue, from West to Frank street, with brick, macadam, Medina block and asphalt.

Decatur, Ill.—Ordinances have been passed for 20,666 square yards of asphalt paving on N. Main street, with curbing, and 76,745 square yards of brick paved street with curbing. E. G. Dickerson, city engineer.

Westport, Kas.—The council passed a resolution, June 17, for paving with Trinidad lake asphalt, Baltimore street, from Thirty-third street to Westport avenue, and Thirty-third street from Main to Wyandotte street.

Pittsburg, Pa.—Grading, paving and curbing ordinances have been recommended to councils for a number of streets and avenues, and for macadamizing Grant boulevard, from Center avenue to Forbes street.

Cincinnati, O.—The board of administration has been asked to include in the specifications for street paving, a new asphalt filling, together with a tar pitch filling, for granite block and brick paving.

Logansport, Ind.—The council has decided to pave with brick the following streets: Third street, 3,747 square yards; Broadway, 10,780 square yards; Wall street, 460 square yards; cement walks, 20,000 square feet. W. B. Ray, city engineer.

Hamilton, O.—An ordinance was adopted June 21 for paving Main street from A to Millville avenue with asphalt block, sheet asphalt or vitrified brick. L. P. Clawson, president board commissioners; M. O. Burns, city clerk.

Burlington, Vt.—The practicability of laying asphalt paving on two blocks of Church street is being considered by the advisory board, which has written for prices on paving for one block as a test of the material.

Denver, Col.—The Arlington Park Improvement Society has been organized by Dr. Long, R. W. Speer, Tom Ward, Jr., C. N. Scott, O. E. Jacobson and A. D. Bishop, to improve the condition of streets and sidewalks.

Binghamton, N. Y.—The resolution for an asphalt pavement on Front street, from Main to Perry, has been reconsidered, and the city engineer directed to prepare plans and specifications for a vitrified brick pavement on concrete.

Syracuse, N. Y.—City Engineer Fisher is preparing two different ordinances for the Lake View park improvement, one providing for brick paving and the other for Hayden vitrified clay blocks. About 2,000 feet of roadway will be paved.

Oyster Bay (L. I.), N. Y.—The plans and specifications for macadamizing the highways have been approved and bids will be advertised for as soon as the $300,000 for which the town is bonded is placed in the hands of Supervisor Samuel J. Underhill.

Butte, Mont.—The city council is considering a proposition to pave Main street, from Copper to Galena with granite blocks on concrete.

Philadelphia, Pa.—A loan of $2,000,000 is suggested, to be devoted to repaving small streets forty feet wide or less.

Springfield, Ill.—Ordinances have been passed for paving ten streets, but bids will not be advertised for until the spring of 1898. Fifth street, between Carpenter street and N. Grand avenue, was excepted from this provision and will be paved at once.

Far Rockaway (L. I.), N. Y.—Vitrified brick paving will be laid on Central avenue, from the village line to Mott avenue, meeting the present brick paving and one block more on Mott avenue, making a continuous brick paved street from the railroad track to Broadway.

Boston, Mass.—The feasibility of laying an asphalt gutter upon all paved streets, as they are constructed, and also of laying a strip of asphalt on the gutters of roadways already paved with granite blocks, will be reported upon by the superintendent of streets.

Leechburg, Pa. — (Special.) — Wilson & Smith, civil engineers, Saltsburg, Pa., say that on June 19 this town voted to increase its indebtedness $21,300 for the purpose of laying about 10,000 square yards of brick paving and to expend the balance on sewer construction.

Hartford, Conn.—Commissioner Buths has submitted a resolution to council for asphalt paving during 1898 for portions of Trumbull, Pleasant, Windsor, Temple, Kinsley, Grove and Prospect streets, and granite blocks for Morgan and Talcott streets.

Freeport, Ill.—A resolution has been offered in the city council providing for the paving, with brick, of N. Galena avenue, S. Galena avenue, Empire, Oak Place, Chicago, Williams, Carroll, Adams, Clay, Exchange, Clark avenue and all streets between Mechanic and Galena streets.

East Orange, N. J.—A petition has been presented to the East Orange committee asking that S. Clinton street, from Central avenue to the South Orange line, be macadamized. The committee has decided to grade, curb and macadamize Midland avenue, from Dodd to E. Park street.

Utica, N. Y.—Final action for paving Liberty street, from Genesee to Washington, will be taken July 9. Resolutions for paving Sunset avenue, from Jewett street to the city line, and for repaving Eagle street, from Steuben street to Park avenue, have been referred to the committee on paving.

Brooklyn, N. Y.—Ocean avenue, from Franklin avenue to Avenue F, will be macadamized. Paving has been favorably reported for other streets as follows: Macadam, Winthrop street, from Flatbush to Rogers avenue; granite, Grant street, from Flatbush to Rogers avenue; asphalt, S. Oxford street, from Fulton street to DeKalb avenue.

Detroit, Mich.—The board of public works and the common council have ordered the paving of a number of streets with cedar or concrete under the clause of the charter permitting the city to pave to an amount of $200,000 in any one year, streets upon which a majority of the property-owners refuse to petition for the work.

Cleveland, O.—Paving has been recommended for the West Side and South End as follows: Block stone—Pearl street, from Franklin avenue to Bridge street and from Loraine street to Walworth Run. Asphalt—Pearl street, from Bridge to Lorain, and River avenue from Lorain street to Denison avenue. Dressed stone—Wilson avenue, from Broadway to Bower street.

Albany, N. Y.—Paving is contemplated as follows: Dimension granite blocks—Hodge street and Steamboat square. Vitrified brick—Ash Grove Place, from Grand street to Trinity Place; Westerlo street, from Trin-

ity Place to S. Pearl street; Van Woert street, from Broadway to end of present cobblestone pavement, Livingston avenue, from Knox to Thornton street. Granite blocks—Hamilton street, from Pearl to Quay street.

St. Paul, Minn.—The estimates of the city engineer for repaving Hill and Washington streets, from Third to Eagle, are as follows: Granite on concrete, $6.45 per front foot, or $7,460; brick, $4.80, or $5,540; sandstone, $5.90, or $6,870. The board of public works will give a hearing on the order for this work July 1. The improvement of Lexington avenue, with a view to making it an approach to Como Park, is being considered. President Wheelock, of park board, interested.

Houston, Tex.—The specifications for paving Washington street include asphalt, gravel and telford macadam. The quantities of the work are: From Third to Houston ave—excavation, 9,000 cubic yards; curbing, 6,500 lineal feet; paving, 11,000 square yards; from Houston avenue to the city limits—excavation, 11,000 cubic yards; curbing, 8,500 lineal feet; paving, 19,000 square yards. O. C. Drew, W. D. Cleveland, Hon. Walter T. Burns and John T. Browne will visit Nashville and will investigate the paving question while there.

Milwaukee, Wis.—The finance committee of the common council has decided to recommend the issue of $72,500 street improvement bonds for laying permanent pavements as follows: Asphalt—Third street, from W. Water to Chestnut; Sixth street, from Grand avenue to Clybourn; Fifth street, from Wells to Cedar; Wells street, from the Oneida street bridge to Third street; Galena street, from Fourth to Twelfth; Eleventh street, from Vliet to Walnut; brick—Washington street, from Clinton to Davidson; macadamizing streets in Thirteenth, Nineteenth, Twentieth and Twenty-first streets.

Newark, N. J.—Mayor Seymour has signed the notice of intention adopted by the board of works which provides for laying a strip of asphalt over the granite blocks on either side of Halsey street, between Camfield and Halsey. Maiden Lane, from Halsey to Washington street, will be repaved with granite blocks, and Eighteenth street, from S. Twelfth to the city line, will be graded and curbed. The West End Improvement Association has appointed a committee to ask the board of works for better lighting, curbing and garbage gathering in that district. A north and south boulevard will probably be laid in East Orange township by the Essex County Park Commission.

New York, N. Y.—(Special.)—The board of aldermen passed resolutions, June 15, directing the commissioner of public works to have the following streets paved with asphalt: West Fifty-fifth street, between Broadway and Eighth avenue; Sixty-fourth st., from Park street to Third avenue; One Hundred and Fourteenth street, from Lenox avenue to St. Nicholas avenue; Fifty-sixth street, from Eighth avenue to Eleventh avenue; Eighty-third street, from E. End avenue to East river; asphalt block on concrete base—Claremont avenue, from 116th to 127th street; 148th street, from Eighth avenue to Bradhurst avenue; 9th street, from Fourth to Fifth avenue, 103d street from Fouth to Fifth avenue; 125th street, from Claremont avenue to Boulevard; 165th street, from Edgecombe to Amsterdam avenue; 179th street, from Kingsbridge road to Amsterdam avenue; 187th street, from 11th avenue to Amsterdam avenue; 185th street, from Wadsworth avenue to Amsterdam avenue; 119th street, from Boulevard to Riverside Drive; 97th street, from Park to Fifth avenue. Among the recent approved papers was that the carriage way of MaCombs Dam road, from Eighth avenue to Central Bridge be paved with asphalt block pavement on concrete foundation; also to repave Sixty-eighth street from Central park west to the boulevard with asphalt pavement on the present stone pavement; also Ninetieth street, from First avenue to East river, to be paved with asphalt on concrete foundation.

CONTRACTS TO BE LET.

Mt. Vernon, N. Y.—Bids will be received until July 6, for grading and macadamizing Elm Place, from Lincoln to Terrace avenue.

Pomeroy, O.—Bids will be received until July 7, for paving sundry streets with vitrified paving blocks. A. A. Massar, city clerk.

Lima, O.—Bids are invited until July 7, for paving two streets with brick and one with asphalt. C. E. Lynch, city clerk.

New Brunswick, N. J.—Bids are asked until July 7 for macadamizing 1 6-10 miles of road. A. Mundy, director board of freeholders.

Port Huron, Mich.—Press reports state that bids are being asked for repaving with brick E. Water and Military streets. F. F. Rogers, city engineer.

Sullivan, Ind.—Sealed bids will be received until July 8 for constructing 77 miles of free gravel roads. J. R. Riggs, county auditor.

Staunton, O.—Sealed bids will be received until July 17 for grading and graveling 3.6 miles of the Worthington road. D. R. Jacobs, engineer.

Harrison, N. J.—Bids will be opened at the July meeting of the common council for repaving Harrison avenue, from the Bridge street bridge to Fourth street.

Clearfield, Pa.—Bids are asked until July 12 for 5,000 square yards of brick paving and 3,600 lineal feet sandstone curb. H. J. Hinterleitner, borough engineer.

Crawfordsville, Ind.—Sealed proposals will be received until July 5 for constructing cement and vitrified brick sidewalks. J. D. Tracy, city clerk.

Camden, N. J.—Bids are invited until July 14, for constructing a gravel road, 11.1 miles more or less in length. E. T. Giel, chairman road committee.

Kane, Pa.—Sealed proposals will be received until July 12 for 6,200 square yards of paving on Fraley street; certified check, $300. Neil C. MacEwen, borough clerk.

Owosso, Mich.—The city council has advertised for bids for paving the business streets with brick. The question of paving will be submitted to vote July 9.

Brazil, Ind.—Sealed proposals will be received until July 6, for paving Washington street, from Main to Kruzan, with brick; bond, $500. John McDonald, city clerk.

Port Clinton, O.—The contract will be let July 6, at public auction, for constructing the proposed Crosby road. Barney Vellequette, clerk commissioners Crosby improved road.

Madisonville, O.—Sealed proposals will be

received until July 3 for constructing cement sidewalks on Julian street, from Central to Ebersole avenue. Bennett Carter, village clerk.

Bellefontaine, O.—Sealed proposals will be received until July 13 for macadamizing Park street, from Sandusky to High avenue. Certified check, $200. W. C. Zearing, city clerk.

Ironton, O.—Sealed proposals will be received until July 14 for improving the east side of Third street, from a point near Pleasant street to Ice creek bridge. George H. Davies, city clerk.

Curwensville, Pa.—Sealed proposals will be received until July 5 for curbing and paving with brick about 10,000 square yards of State and Filbert streets. D. S. Moore, secretary commissioners.

Dayton, O.—Sealed proposals will be received until July 6 for 450 square yards of asphalt, vitrified block or brick paving and 300 lineal feet of curbing on Lawrence street. O. E. Davidson, president board city affairs.

Terre Haute, Ind.—Sealed proposals will be received until July 20 for grading, curbing and paving with screened gravel Tenth street, from Sixth to Eighth avenue. Bond, $200. Charles H. Goodwin, city clerk.

Brookhaven, Mass.—Sealed bids will be received until July 5 for working first-class public roads Nos. 1 to 11 inclusive, and until Aug. 20 for all second-class roads. Felix May, clerk board supervisors.

Arcola, Ill.—Sealed bids will be received until July 8 for grading, curbing and paving with brick Main street, from Pine to Sheldon. Certified check, $500. L. B. Chambers, mayor; W. J. Charlton, city clerk.

Hoboken, N. J.—Bids are asked until July 7 for 44,100 square yards of asphalt paving, 38,500 square yards of block pavement under asphalt and 18,600 lineal feet of curbing. M. V. McDermott, city clerk.

Bluffton, Ind.—Bids will be received until July 6 for constructing the Asbury Chapel free gravel road, 36,090 lineal feet in length. Certified check, $5,000. John H. Trosel, engineer and superintendent.

Bedford, Ind.—Sealed proposals will be received until July 13 for constructing 115,998 lineal feet of gravel and macadam roads in Spice Valley township. John B. Malott, county auditor.

New York, N. Y.—Bids are asked until July 6 for paving with asphalt portions of Roosevelt, Market, Fifteenth, Eighty-third and Forty-seventh streets. Charles H. T. Collis, commissioner public works.

Wilmington, Del.—(Special.)—Sealed proposals will be received until July 6 for furnishing 10,000 square yards, more or less, of vitrified paving bricks and blocks. Certified check, $500. Harvey J. Wiley, secretary street and sewer department.

Jacksonville, Fla.—Sealed proposals will be received until July 20 for laying a corrugated vitrified brick sidewalk on Main street in front of the water works' grounds; certified check, $100. B. F. Dillon, chairman W. W. Com.

Cincinnati, O.—Sealed proposals will be received until July 20 for macadamizing, curbing, etc., Kinsey avenue, from Cumberland street to Auburn avenue, and Ingleside avenue, from McMillan street to Forest avenue. A. P. Butterfield, clerk B. of A.

Danville, Ill—Sealed proposals will be received until July 22 for curbing with stone, Sherman, E. Main, English, Fairchild, Outten, Oak and South streets and Park, Bowman and Payne avenues; certified check, $100. R. E. Lloyd, city clerk.

Albany, N. Y.—Sealed proposals will be received until July 6 for paving with brick and curbing Second street, from Knox to Judson. Also for paving with brick and curbing the carriage-way of the Knox street viaduct. Thomas J. Lanahan, clerk.

St. Louis, Mo.—Sealed proposals will be received until July 9 for constructing new brick sidewalks and repairing streets and sidewalks with brick, artificial stone, granite, curb, gutters, etc. Robert E. McMath, president B. P. I.

Iowa City, Ia.—(Special.)—Sealed proposals will be received until July 2 for paving with brick and curbing Clinton street, from Jefferson to Church, brick paving, 13,620 square yards; new stone curbing, 3,360 lineal feet; resetting old curbing, 1,120 lineal feet; grading, 5,800 cubic yards; certified check, $800. Arthur J. Cox, city engineer; W. J. Bowen, city clerk.

CONTRACTS AWARDED.

Lansdowne, Pa.—The contract for macadamizing was awarded to Kemp & Co. of Washington, D. C., at 14⅞ cents a square yard.

Huntington, Ind.—The contract for constructing brick paving was awarded to Charles Kinney of Elkhart for $28,000.

Trenton, N. J.—The contract for paving N. Clinton-st., from Oak-st. to Tyrell-ave., was awarded to Wm. F. McGovern.

Muscatine, Ia.—The bid of Fuller & Fahey, $19,391, was accepted, June 5, for brick paving in improvement district No. 13.

Galesburg, Ill.—The bids received, June 7, for brick paving were rejected and new ones asked until June 21.

Rochester, N. Y.—The contract for improving Lyell-ave. was awarded to the Rochester Vulcanite Paving Company for $91,963.35.

Memphis, Tenn.—The contract for paving Shelby-st., from Beale to Calhoun, with brick, was awarded to M. Larkin.

Elwood, Ind.—P. T. O'Brien was awarded the contract, June 14, for a half-mile of brick paved streets at $1.32 a square yard.

Menasha, Wis.—Press reports state that J. H. Green & Co. were the lowest bidders for cedar block paving on Washington-st.

Mt. Pleasant, Pa.—The contract for 6,000 square yards of paving has been awarded to Wier & McIntyre of McKeesport for $8,545.

Braddock, Pa.—The contract for paving Corey-ave., from Mille-ave. to Second-st., with brick, has been awarded to McCrady & Rosser.

Westport, Mo.—The Barber Asphalt Paving Company was awarded the contract for paving Main-st. with asphalt at a cost of $46,000.

St. Joseph, Mo.—Bids were received, June 22, for repairing the asphalt streets, but the awarding of the contract was deferred until June 25.

Newport, Ky.—(Special.)—T. C. Brown, of this city, was the lowest bidder, June 16, for combined curb and gutter of crushed granite, at 70 cents a lineal foot.

Chelmsford, Mass.—E. H. Keys, of North Chelmsford, was awarded the contract, June 19, for constructing a half mile of highway on Princeton street for $1,140.

Waseca, Minn.—The St. Paul Sidewalk

Co., St. Paul, Minn., was awarded the contract for constructing new cement sidewalks at the new court house, at $1.35 a square yard.

Mahanoy City, Pa.—The contract for paving Center street, between Fourth and Catawissa, was awarded to Jones & Wallace, of Philadelphia, at $1.65 a square yard, for Mack brick.

Chester, Pa.—The contract for paving Providence avenue with vitrified blocks was awarded, June 7, to Jesse Baptiste at 20 cents a square yard for old and $1 for new blocks.

Baltimore, Md.—The Maryland Pavement Co. secured the contract, June 14, for repaving Patterson avenue, from Fremont to Fulton avenue, with asphalt blocks, at $2.25 a square yard.

Kansas City, Mo.—The contract for macadamizing three miles of Lee's Summit and Lone Jack roads was awarded, June 19, to C. W. Dobbins, of Pleasant Hill, at $1.25 a square yard.

Milwaukee, Wis.—The contract for 6,256 feet of stone curbing on Richard street was awarded to J. F. Beers at 31.40 a foot, and for 828 feet on Reed street to C. Edson at 32 cents a foot.

Flora Park, Ill.—The contract for macadamizing the old East Rockaway road, from the Merrick road at Lynbrook to East Rockaway, 1¾ miles, was awarded to J. B. Russell for $16,358.

Wilmington, Del.—The board of park commissioners awarded to Simmons & Bro., June 19, the contract for paving the east side of the boulevard, between Washington bridge and Eighteenth street, at $1.39 a square yard.

Waterbury, Conn.—Wardwell & Bros., of Danbury, Conn., were awarded the contract for 1,766 square yards of vitrified block paving on Bank street and Harrison avenue for $4,627.28. Mahon & Porter vitrified blocks will be used.

Milwaukee, Wis.—The contract for constructing 10,000 lineal feet of curbing in the thirteenth ward was awarded to E. H. Raymond at 31½ cents a lineal foot. Edward Becker and John Donahue secured the contract for curbing Claybourn street, from Seventh to Thirteenth.

Cedar Rapids, Ia.—The contract for brick paving was awarded to the Likes Improvement company, of Des Moines, Ia., at 99 cents a square yard for Galesburg brick. The company has sublet the contract for curb setting to J. B. Patterson. The work of construction will begin July 1.

Albany, N. Y.—T. Henry Dumary secured contracts, June 8, for paving Main avenue, from Madison to Western avenue, $3,422.20; Yates street, from Knox to Lexington avenues, $7,324.50; and on June 23 for Third street, from Quail street to New York Central avenue, for $26,536.50.

Kokomo, Ind.—Contracts for constructing 12 miles of gravel road have been awarded as follows: O. J. Summers, Wabash, Ind., two sections, $10,228; Donnelly & Cunningham, city, two sections, $13,170.95; Irvin Tennell, West Liberty, Ind., one section, $5,213.94.

Pittsburg, Pa.—Booth & Flinn were awarded the contract, June 14, for repaving with asphalt, Walnut, Craig, Calvin, Stanton, Forty-fourth and Forbes streets, Virginia alley and Fifth avenue, at prices ranging from $1.54 to $1.62 a square yard, and grading at 14 cents a cubic yard.

Camden, N. J.—B. F. Shanley & Son of Philadelphia were awarded the contract, June 9, for extending the stone road from Mt. Ephriam to Market street, Gloucester, and B. F. Sweeten & Son the contract for building the white house pike extension from city line to Haddon avenue.

Saginaw, Mich.—The bids received June 4 for paving Jefferson street with asphalt were as follows: John C. Davies & Co., $1.60 a square yard; C. I. Williams, Alcatraz asphalt, $1.65; Barber Asphalt Paving Co., $1.99; Ayres Asphalt Paving Co., Painesville, O., $2.05; Western Bermudez Co., $2.09.

Peoria, Ill.—The Warren-Scharf Asphalt Paving Company was the only bidder, June 11, for paving Bigelow street and was awarded the contract. Its bid was $1.89 a square yard for asphalt; combined curb and gutter, 81 cents a lineal foot; setting limestone headers, 6 cents a square foot; excavating, 30 cents a cubic yard.

Chattanooga, Tenn.—Bids were received, June 12, for the asphalt repairing on Seventh street, between Broad and Market, as follows: Standard Paving Co., $1.70 a square yard for resurfacing, and $2.15 for resurfacing and concreting; Warren-Scharf Asphalt Co., $1.80 for resurfacing and $2.50 for resurfacing and concreting.

Sioux City, Ia.—(Special.)—The Barber Asphalt Paving Co. has been awarded contracts as follows: Pearl street, between Fourth street and Perry Creek, amounting to 9,100 square yards. Also Jackson street and Nebraska street, amounting to 12,600 square yards, making a total for three streets of 21,700 square yards.

Chicago, Ill.—The corporation paving contract was awarded, June 11, to John McCarthy. The contract, which is worth $75,000, gives the contractor the privilege of repairing all streets and alleys torn up by gas companies and street car companies and includes repairs to asphalt, granite, macadam and cedar blocks.

Springfield, Mass.—The contract for paving Main and State streets with vitrified paving brick was awarded, June 11, to Cain & Kinnear of Dayton, O., as follows: Outside of rails, brick, on cement, 79 cents a square yard; tar, 82 cents; composition, 86 cents; sand, 73 cents.

Sharpsburg, Pa.—(Special.)—E. C. Hurlburt, borough engineer, says that the contract for repaving Clay and Canal streets with brick was awarded to J. B. Sheets at $1.27 a square yard for paving on six-inch concrete, and 10 cents a lineal foot for resetting curb. The bids were received May 4, but the letting of the contract was delayed on account of an irregularity in the Sheets bid.

Louisville, Ky.—Bids were received June 18 for the reconstruction of Kentucky street, as follows: Barber Asphalt Paving Company, $24 per foot; Breckenridge Asphalt Company, $20.54. It is said that the contract will probably be awarded to the Breckenridge company. The bid of the Ohio Bermudez company, the only other bidder, aggregated $12,285.30.

Hagerstown, Md.—The contract for paving three blocks of Potomac street was awarded to Edmund G. Buck of Bedford City, Va., recently, at $1.34 a square yard, for McMahon-Porter vitrified brick, but John T. Clarkson, a competing contractor, has filed a bill for an injunction against the street commissioners, mayor and council, restraining

them from doing anything further in the matter.

Hartford, Conn.—(Special.)—George Meyers, clerk board of street commissioners, says that the contract for 17,000 square yards of asphalt paving on six-inch concrete base, on Main street, was awarded, June 9, to the South New England Paving company at $2.66 a square yard for Trinidad lake asphalt. The removal of macadam and grading will be done by the city. The bids for the work were received May 5.

Erie, Pa.—Charles I. Williams of the Alcatraz company, Utica, N. Y., was awarded the contract, June 3, for paving Holland street, from Sixth to Eighth, with asphalt, as follows: Paving, $1.99 a square yard; catch basins, $25; manholes, $30; nine-inch pipe, 45 cents; six-inch pipe, 40 cents; landmarks, $3. The only other bidder was Mayer Bros., at $2.25 for Trinidad Lake asphalt and $2.17 for Trinidad land asphalt.

Napoleon, O.—Bids were received June 5 for 14,768 square yards of brick paving on Washington street, from fifteen companies. The bids were based on Metropolitan repressed and wire-cut blocks, Athens, Springfield, Townsend, Buckeye, Bolen, Hallwood, McMonigal, Blue Granite, Jones, Wassal, Wooster and Trimble block. The lowest of these bids aggregated $17,978.98, and was presented by the McMahon company of Toledo.

Johnstown, Pa.—Brick paving contracts have been awarded as follows: Bader & Co., Vine and Broad streets, $1.24 a square yard; Conemaugh street, $1.10; John V. Bart, Cedar street, fire brick, 33 cents a square yard; S. R. Weimar, extension of Ash street and Grove avenue to connect Seventh and Seventeenth wards, $3,400; Daniel Caufield, Village street, $1,037; Arthur McPike, paving sidewalks on Iron street, 43½ cents a square yard; Eighth ward sewer, 19½ cents a foot.

Allegheny, Pa.—Contracts were awarded June 10, as follows: Regrading, repaving and recurbing Hight street with Ligonier block, Booth & Flinn, $10,685; granolithic sidewalks on Sandusky and Federal streets, from Stockton to Church avenue, Filbert Paving company, $327.60 and $393.40 respectively. The Park Fire Clay company was awarded the contract for furnishing the city with 1,000,000 standard paving brick at $7.60 per 1,000.

St. Louis, Mo.—The board of public improvements received bids June 11 for the annual street repair contract, but decided to reject all bids except those received for the repair of alleys with granitoid, brick or granite, which were awarded as follows: First district, Hill-O'Mera Construction company, $530; Second district, Julius F. Diekroeger, $1,830; Third district, Hill-O'Mera Construction company, $354.

Brooklyn, N. Y.—The contract for laying asphalt strips on Bedford avenue was awarded to Cranford & Co. for $2,000. John Maillie & Co. secured the contract, May 25, for constructing a macadam roadway on the west driveway of Ocean Parkway, as follows: Block gutters, 30 cents a foot; bed curb, 8 cents a foot; macadam, 72 cents a square yard; macadam, cobble and trap, 67 cents a square yard; 8-inch cement pipe, 75 cents a foot.

Rockford, Ill.—The Barber Asphalt Paving company of Chicago was awarded the contract for asphalt paving on 6-inch foundation, with six-year guarantee, at $1.65 a square yard. The other bids received were: Schillinger Bros., Chicago, 4-inch foundation, $2; Eastern Paving and Supply company, Chicago, 4-inch foundation, $1.87; Bermudez Paving company, Chicago, 4-inch foundation, five-year guarantee, $1.57, and six-year guarantee, $1.68. The brick contract was awarded to G. Maffioli at 83 cents a square yard for Springfield brick.

Des Moines, Ia.—Bids were reveived June 11 for grading, paving and curbing a number of streets. The bids for paving Center street, from Sixth avenue to Seventh, were: W. A. Youngerman, $1.23½; J. H. Killmar, $1.25; J. B. McGorrisk, $1.25. Curbing: Park, from Fifteenth to Sixteenth: C. G. Sheely & Co., 32 9-10 cents; H. A. King, 34¼ cents; Chestnut street, from Seventh to Eighth, 32 9-10 cents; H. A. King, 33 1-3 cents. Bids were received for grading eighteen streets.

Detroit, Mich.—The Alcatraz Asphalt Paving company has been awarded the contract for repaving Mt. Elliott avenue at $1.91 a square yard, or $23,706.68. The bond guarantees the pavement for ten years. The Warren-Scharf Asphalt Paving company was awarded the contract for keeping the old asphalt pavements originally laid by it in repair, at $2 a square yard, and if the concrete foundation is cut into, $2.65 a square yard. The total amount of pavement under this repair contract is 107,332 square yard.

Lancaster, Pa.—Paving contracts were awarded, June 17, as follows: Brick—S. Prince street, from German to Vine, A. Steinwandel, $1.58 a square yard; S. Duke street, from E. King to Vine, McGrann & Malone, $1.60. Vitrified blocks—N. Prince street, from Lemon to Frederick, A. Steinwandel, $1.83 a square yard. Macadam—College avenue, from Chestnut to Walnut, J. W. Musser, $1,028; Clay street, from N. Queen to Duke, McGrann & Malone, $850; S. Shippen street, from Howard avenue to Green street, J. W. Musser, $1,166; Coral street, from Third to Fourth, J. W. Musser, $650.

Davenport, Ia.—Bids were received recently and contracts awarded, but the kind of brick has not yet been decided upon, as follows: Flick & Johnson—Alley between Eighth and Eleventh and Brady and Main streets: Buffalo brick, $2,415.10; Purington brick, $2,550.76; Park avenue, Buffalo brick, $3,075.26; Purington brick, $3,129.24. Edwards & Walsh Construction company—Alley between Sixth and Seventh and Rock Island and Iowa streets: Buffalo brick, $841.60; Purington brick, $891.51; alley between Second and Third and Harrison and Ripley streets: Buffalo brick, $848.26; Purington brick, $898.17; LeClaire street, from the government bridge to Third street: Buffalo brick, $3,072.23; Purington brick, $3,230.43.

Detroit, Mich.—The contract for paving Park street, from Adams to Peterboro, was awarded June 24 to George E. Currie for $10,491.58. The Warren-Scharf Asphalt Paving company bid $21,163.85 for paving this section of the street with asphalt, and $16,975.70 for paving it from Adams to Sibley. Bids were received also for paving Beaubien street, from Gratiot to Adams, with cedar as follows: George A. Burch, $2,761.79; H. Meridian, $2,940.24; Talbot Paving company, $2,808.80. Brick—Beaubien street, from Gratiot to Beacon: A. Burch, $3,071.47; Talbot

Paving company, $3,062.27. Cedar on concrete—Helen avenue, from Gratiot to Boulevard: G. A. Burch, $11,782.22; G. E. Currie, $11,182.90; William R. Lappen, $11,091.44 Laidlaw & Co., $12,722.62; James Grant, $13,398.03; Talbot Paving company, $10,711.85.

Buffalo, N. Y.—The Barber Asphalt Paving company presented the lowest bid, June 10, for paving N. Pearl street, between Allen and North, at $6,417. The Utica Paving company was the lowest bidder, June 14, for paving and repaving portions of Jefferson street, Miller avenue, Commercial, Pine, Pearl and N. Pearl streets, and on June 15 for paving Como and Crescent avenues and Amherst and Niagara streets. The company bid on Alcatraz asphalt, but in each instance its bid was objected to owing to the fact that there was no formula on file or specified, and the commissioners decided to not try any new kinds of asphalt until the time of the guarantee was extended. The Utica Paving company says it will fight its way in this city as it did in Philadelphia, New York, Erie, Detroit and other cities.

Newark, N. J.—Bids were received June 7 for paving with asphalt, Camden, New and Court streets and Milford avenue. The lowest bid on Camden and New streets was presented by George McDonald, who represented the Columbia Construction company, which was $2.10 a square yard. The New Jersey Asphalt company bid $2.36 on each street, which was from 10 to 12 cents a yard less than the company originally bid on these streets. A petition was presented to the board of works, June 24, representing 98 per cent. of the property-owners on Camden street asking that the contract be awarded to George McDonald at his bid of $2.10. The other companies bidding were the Metropolitan Asphalt Paving company, Sicilian Asphalt company, John F. Shanley and California Asphalt company, and their bids ranged from $2.36 to $2.45 on Camden and New streets and from $2.40 to $2.47 on Milford avenue.

New York, N. Y.—(Special.)—At a meeting of the Commissioners of Public Parks, May 24, the following bids were received and contracts awarded, viz.: For paving with asphalt the unpaved portion of the sidewalks of Transverse Roads Nos. 1, 2 and 3, crossing the Central Park from Fifth avenue to Central Park, west, 32,500 square feet walk pavement of asphalt, with concrete base, rubble stone foundation: The Barber Asphalt Paving Co. at 25c, total $8,125.00; the Sicilian Asphalt Paving Co. at 19½c, total $6,337.50; Warren-Scharf Asphalt Paving Co. at 18¼c, total $5,931.25; T. Hugh Boorman at 29 7-10c, total $9,652.50; awarded to Warren-Scharf Co. For paving with asphalt the sidewalks adjoining Manhattan Square, in Central Park west and Columbus avenue, between Seventy-seventh and Eighty-first streets, 20,000 square feet of walk pavement of asphalt with concrete base, rubble stone foundation: The Barber Asphalt Paving Co. at 25c, total $5,000; the Sicilian Asphalt Paving Co. at 19½c, total $3,900; Warren-Scharf Asphalt Paving Co. at 18¼c, total $3,650; T. Hugh Boorman at 23 7-10c, total $4,740; awarded to Warren-Scharf Co. contract for 16,000 square feet of pavement of Concrete and mortar of Portland cement in Battery Park was awarded to Cornelius O'Grady, the lowest bidder, at 17 cents per square foot, thirty cubic yards of concrete in place $8.00, total $2,960.

Indianapolis, Ind.—The contract for paving Kentucky avenue, from Missouri street to the river, was awarded, June 9, to the Warren-Scharf Asphalt Paving Co. at $3.92 a lineal foot. The contract for repairing all asphalt and vulcanite pavements on which the guarantee had expired was awarded to the United States Silica Co., on a one-year guaranty, as follows: For inch to inch-and-a-half-coating, 85 cents a square yard; resurfacing to foundation, $1.10, and resurfacing to new concrete foundation, $1.90 a square yard. Bids were received, June 23, for paving Indiana avenue with asphalt as follows: Breckenridge Asphalt Co., $4.28 a lineal foot; Western Paving and supply company, $5.01; Warren-Scharf Asphalt Paving Co., $5.17; Indiana Bermudez Co., $5.18. The awarding of the contract was deferred until the city engineer could visit Louisville to examine some of the asphalt streets laid by the Breckenridge Asphalt Co. in that city.

Kansas City, Mo.—The contracts for paving Tracy avenue, between Ninth and Twelfth streets, and Seventeenth, between Grand and Oak streets, was awarded, June 22 to the Parker-Washington Paving company as its bid of $2 a square yard for Tracy avenue and $2.08 for Seventeenth street. The property-owners on these streets petitioned that the contract be awarded to the Barber Asphalt Paving company at $2.12 a square yard representing that they did not want the thoroughfare experimented with. Other contracts awarded June 22 were: Lydia avenue, from Twelfth to Fifteenth, asphalt, Barber Asphalt Paving company, $2.12 a square yard; Cherry street, from Independence avenue to Eighth street, vitrified brick, H. S. Trestrail, $1.22¾; Indiana avenue, from Eighteenth to Thirty-first street, McTiernan & Halpin, 99½ cents a square yard. The board of public works awarded to the Barber Asphalt Paving company, June 5, the contract for paving Sixteenth street, from Oak to Locust, at $2.12 a square yard. In this instance the Parker-Washington company bid $2.10, but the board decided that as that company was in default to the city on one contract, Broadway, from Sixteenth to Twenty-first street it was not to be relied upon. City Engineer Wise rescinded the contract, however, and on June 8 awarded the contract to the Parker-Washington company at $2.10 a square yard. Mr. Wise claims that he learned that the company had its material on hand and was prepared to do better work than it had done on other contracts. The Barber Asphalt Paving company secured the contract, June 5, for paving Sixteenth street from Broadway to Summit, at $2.12 a square yard.

Indianapolis, Ind.—S. H. Shearer, local manager of the Western Paving and Supply company, appeared before the board of public works on June 8 and protested against the award of the contract for paving Indiana-ave. to the Breckenridge Asphalt company. He submitted photographs of streets in Louisville paved by the Breckenridge company, and samples of the material, which, he said, had been kicked out of chuck holes. The contract required the use of a mixture of Kentucky and German rock asphalt, but he said that instead of the latter a rock asphalt from the Indian territory had been substituted. The report of a commit-

tee of the Louisville board of aldermen was read, denouncing the work in strong language, and letters were also read from Aaron Kahn, president, and Joseph Nevins, a member of the Louisville board of public works, saying that the work of the Breckenridge company in that city was inferior. Further objections were made to the award on the ground that the Breckenridge company had not complied with the section of the specifications requiring bidders to show that they had laid a pavement similar to the kind bid on, and that it had stood the prescribed tests. Chairman Downing said that he was "satisfied that the pavement in Louisville is a failure," but that a pavement of that kind would not be accepted in Indianapolis, and that a bond would be required which would compel compliance with the specifications. He announced that the contract would be awarded to the Breckenridge company on its bids of $4.28 a lineal foot, each side.

SEWERS.

New Orleans, La.—The first work on the drainage system began June 14, and it is thought it will be completed in six months.

Philadelphia, Pa.—The Aramingo canal sewerage system, which has been in course of construction since 1888, is nearing completion. Its probable cost will be about $1,000,000.

Westport, Kas.—This city's $100,000 sewerage system, which was established on the tax bill plan, cannot be operated until it is decided whether or not the law giving the city the power of construction is constitutional.

Macon, Ga.—A proposition will probably be made to the mayor and council to submit the differences between them and Stephen N. Noble, the sewer contractor, to a board of arbitration for settlement. Mr. Noble, who had the contract for constructing a sewerage system, entered suit in the United States court for about $72,000 for extras.

CONTEMPLATED WORK.

Mechanic Falls, Me.—Surveys have been made for a sewerage system.

Belmar, N. J.—This town has voted to bond for $85,000 for sewers.

Watertown, Mass.—Sewers are contemplated for eleven streets.

Lexington, Ky.—A sewer is proposed from Race to Limestone street.

Red Wing, Minn.—The construction of a sewer in Sixth street is petitioned.

Belvidere, Ill.—A new sewer ordinance was passed June 14.

Coxsackie, N. Y.—This village is being surveyed for a sewerage system.

Hartford, Conn.—Bids will be asked for constructing sewers in two streets.

Woodbridge, N. J.—Sewers have been favorably voted on for Main, Fulton and Albert streets.

Florence, Mass.—Sewers will probably be built on High and N. Maple streets this summer.

Moline, Ill.—The construction of the tail-race sewer is contemplated; estimated cost, $12,000.

Spokane, Wash.—The board of public works contemplates laying over a mile of sewer.

Spencer, Mass.—The construction of sewers is badly needed in Pond and Pearl streets.

Fairmount, W. Va.—Action is being taken toward the establishment of a sewerage system in this town.

Richmond, Va.—The finance committee decided, June 17, to borrow $10,000 for sewer construction.

Onset, Mass.—Plans are being perfected for a sewerage system. H. E. Gifford interested.

Macomb, Ill.—Bids will be advertised for soon for 4,100 feet of 18-15-inch pipe sewer. Mayor Odenwaller.

Boulder, Col.—The city council has decided to build a new sewer between Pine and Hill streets.

St. Joseph, Mo.—An ordinance has been passed providing for two sewers in South St. Joseph.

Concord, N. H.—The construction of an extension to the South End sewer has been favorably voted on.

Newport, Me.—This town is planning to build a sewer, surveys for which were made several years ago.

Parkersburg, W. Va.—The question of issuing bonds for the extension of the sewerage system will be voted on.

Ft. Wayne, Ind.—The construction of a main sewer in Monroe street is contemplated by City Engineer Randall.

Troy, N. Y.—A resolution has been passed for a twelve-inch pipe sewer in Twelfth street, with manholes, catchbasins, etc.

Fond du Lac, Wis.—The city engineer was instructed, June 15, to prepare plans for a sewer in Ellis street.

Toledo, O.—Plans have been approved for a sewer seven and one-half feet in diameter in district No. 26. Lem P. Harris, city clerk.

Winthrop, Mass.—Bids will probably be asked soon for the construction of sewers for Winthrop Highlands.

Newport, Me.—The proposed construction of a sewerage system has been favorably voted on.

Colchester, Ill.—The street and alley committee are considering a petition for constructing a sewer in Market street.

Ottawa, Can.—The question of building the proposed new sewerage system will be voted on July 14. City Clerk Henderson.

Boonville, Mo.—The proposition to issue $10,000 in bonds for the construction of two sewers was favorably voted on June 1.

Topeka, Kan.—Plans are being prepared for sewers in the East Side drainage or sewer district by Councilman Mergan.

Janesville, Wis.—Mayor Thoroughgood is in favor of taking immediate action toward the construction of a sewerage system.

Webster, Mass.—The plans prepared by Engineer Taylor of Worcester provide for an expenditure of $15,000 for sewer construction.

Scranton, Pa.—Ordinances passed third reading, June 17, providing for lateral sewers on Prescott avenue and Farber court.

Waltham, Mass.—Mayor Pond has recommended that action be taken immediately toward the construction of a sewerage system.

Pawtucket, R. I.—A resolution was passed, June 16, appropriating money for sewers in Pleasant, Merry and Tidewater streets.

Reading, Pa.—A resolution has been passed

to appropriate $1,500 for a storm water sewer on Seventh street, betwen Pennsylvania and Washington.

Braddock, Pa.—Edeburn & Cooper, of Philadelphia, have been authorized to prepare plans for a sewerage system in North Braddock.

Joplin, Mo.—Mayor Cunningham recommended, in his annual message, municipal water works, an improved sewerage system and an electric light plant.

Baltimore, Md.—Mayor Hooper has signed the measure appropriating $12,000 out of the $6,000,000 sewer loan for sewers on Clifton avenue and Payson street.

Lafayette, Ind.—The committee on finance and sewers recommends the construction of sewers in Ninth, First, Second, Cincinnati and other streets.

Lynn, Mass.—An order was adopted by the council, June 8, authorizing the construction of a sewer in Eastern avenue, between Huron and Essex streets.

San Rafael, Cal.—An ordinance has been passed by the council authorizing the construction of a gravity outfall sewer. J. I. Burtin, city clerk.

Catskill, N. Y.—Surveys and plans for a sewerage system and the establishment of sidewalks and street grades will be made by Engineer Chism of New York City.

Woonsocket, R. I.—The joint standing committee on sewers recommended, June 9, that sewers be constructed in Seventeenth street. An additional appropriation of $18,000 is askd.

Erie, Pa.—Ordinances have been passed for constructing an 18-inch sewer in Liberty street, between Twentieth and Twenty-third streets. Sewers are proposed for Fifth and French streets.

Chelsea, Mass.—The finance committee has recommended the adoption of an order authorizing the expenditure of $10,000 for the connection of sewers with the metropolitan system.

Vailsburgh, N. J.—Frederick T. Crane, city engineer at Orange, has been engaged to make plans and specifications for a sewerage and water works system for this borough and for Irvington.

Cleveland, O.—Plans for a sewerage and water works system have been submitted to the Glenville council by Engineer Force, which will be placed before the state board of health for approval.

Oakcliff, Tex.—The Oakcliff Sewage company has been chartered by H. M. Crow, M. Thomas Edgerton and W. L. Diamond for the purpose of constructing and maintaining a system of sewerage in this place.

Youngstown, O.—Resolutions were passed in the council, June 7, for sewers in W. Woodland avenue, from Mill to S. Market street, and Marshall street and West avenue, from Edwards street to Mahoney street. F. G. Brown, city clerk.

Los Angeles, Cal.—Final ordinances will be passed for constructing sewers on Gleason avenue, from Mott to Mathews street, and Mathews street, from Gleason avenue to First street, and for the improvement of First, Second, Albion and Albany streets.

Seattle, Wash.—The city council passed a resolution, June 7, to construct an ironstone pipe sewer in Howell street, with all necessary Y's, openings, manholes, catchbasins, ventilators and flushtanks. William Chapman, president pro tem. of the city council.

New Rochelle, N. Y.—A special election will be held July 7 to vote on an appropriation of $65,000 for sewerage improvements, the voters to have their choice in voting for disposal works, a pumping station, or extending the present system further into the sound.

CONTRACTS TO BE LET.

Mt. Vernon, N. Y.—Bids are asked until July 20 for constructing a lateral sewer on S. Tenth avenue.

Red Oak, Ia.—Bids will be received until July 6 for 1,950 feet of eight-inch sewer. O. E. Jacobson, city clerk.

Wausau, Wis.—Bids will be received until July 6 for the main east side sewer. J. C. Kuhlmann, city clerk.

Union, N. J.—Bids are asked until July 6 for constructing a fifteen-inch pipe sewer. Charles Singer, town clerk.

Terre Haute, Ind.—Bids are asked until July 20, for constructing a sewer on Eleventh street. Charles H. Goodwin, city clerk.

Bozeman, Mont.—Bids will be received until July 15 for furnishing vitrified sewer pipe, eight to twenty-four-inch in car load lots.

Evansville, Ind.—Sealed proposals will be received until July 5 for constructing sewers. George W. Swearingen, clerk board of public works.

Vallejo, Cal.—Bids are asked until July 7 for constructing about three thousand feet of eighteen to eight-inch pipe sewers. C. F. Mugridge, city clerk.

Paducah, Ky.—Sealed bids will be received until July 5 for the construction of a system of sanitary sewers. D. A. Yieser, mayor.

Sparta, Wis.—Sealed proposals will be received until July 3 for constructing a sewer on Main street. P. Miller, chairman joint committee.

Melrose, Mass.—Sealed proposals will be received until July 3 for building section 1 of the sewerage system. W. D. Hunter, engineer and superintendent.

Belfast, Me.—Sealed proposals will be received until July 6 for building 800 feet of sewer on Pearl street and 200 feet on Park street. Clarence O. Poor.

Mishawaka, Ind.—Sealed proposals will be received until July 5 for constructing a pipe sewer. William M. Whitten, South Bend, engineer; George A. Themel, town clerk.

Crawfordsville, Ind.—Sealed proposals will be received until July 5 for constructing a three-foot brick storm sewer on Binford and Pine streets. J. D. Tracey, city clerk.

Salem, O.—Bids are asked until July 6 for constructing sewers in Lincoln and Franklin avenues, and until July 20 for a sewer in E. Main street. F. W. Allison, city clerk.

Warren, O.—Sealed proposals will be received until July 20 for constructing a lateral sewer on Floral, Buckeye and N. Tod streets. Albert E. Andrews, city clerk.

Geneseo, N. Y.—Sealed proposals will be received until July 14 for deepening 439 feet of sewer pipe in Center, Main and Bank streets. W. A. Wadsworth, chairman street commissioners.

Washington, D. C.—Sealed proposals will be received until July 10 for constructing the Tiber creek and New Jersey avenue high

level intercepting sewers. John W. Ross, chairman.

Wheaton, Ill.—Bids will be received until July 10 for furnishing 27,776 feet of 2 to 8-inch sewer pipe, manholes, catch basins, flush tanks, etc. G. I. Herrick, city engineer.

Cynthiana, Ky.—Bids are asked until July 13 for constructing about 3,600 feet of 15 to 6-inch pipe sewers, 5,307 branches, etc. E. F. Layman, Cincinnati, O., C. E.; L. S. Williams, city clerk.

Boston, Mass.—Sealed bids will be received until July 3 for building section 51, Metropolitan sewerage system, in Melrose and Stoneham. Certified check, $500. William O. Brown, jr., chief engineer.

Hackensack, N. J.—Bids are asked until July 12 for constructing about 5,100 feet of 66 to 24x36-inch brick and about 3,200 feet of 24 to 18-inch pipe sewers. M. E. Clarendon, president Hackensack improvement commission.

Frankfort, Ind.—(Special.)—Bids will be refeet of 10, 12, 8, 6-inch vitrified tile sewer, 20 man holes, 11 lamp holes and 4 flush tanks. Alonzo J. Hammond, city engineer.

Momence, Ill.—Sealed proposals will be received until July 17 for the construction of a main ditch and six branches in the Hopkins drainage district, aggregating eleven miles.

Hoboken, N. J.—Sealed proposals will be received until July 7 for the construction of a brick sewer in Park avenue, between Ferry and Newark streets, and at the intersection of Clinton and Second streets. M. V. McW. F. Kenaga, drainage commissioner.

ceived until July 2 for furnishing and laying 35,350 feet 8, 10, 12, 15, 18-inch vitrified sewer pipe, 51 manholes and 29 flush tanks. Certified check, $1,000. James McLarnon, secretary commissioners public works.

Cohoes, N. Y.—Sealed proposals will be received until July 6 for the construction of 9,000 feet of tunnel, including manholes, two inverted siphons and outfall for the trunk sewers. Certified check $1,000. William J. Elliott, clerk public improvement commission.

Albany, Ill.—Sealed bids will be received until July 7 for furnishing all material for constructing culvert and gate works, including 6 tons 48-inch cast iron pipes, 120 cubic yards concrete masonry, 30 cubic yards brick masonry, two sets cast iron gates and frames. E. D. Bigelow, president drainage district commissioners.

CONTRACTS AWARDED.

Grand Rapids, Mich.—A. Prange secured the contract, June 19, for a sewer in E. Bridge street, for $2,388.

Newark, N. J.—The contract for building the Willow avenue sewer was awarded to Michael Lyon, June 15.

Nashville, Tenn.—The contract for constructing a sewer in Shield street has been awarded to Perry and Smith, for $1,899.25.

Detroit, Mich.—Sewer contracts were awarded, June 19, to James Hanley, John Wagner, John Jeynes and Langley & Jeynes. Jeynes.

Rankin, Pa.—The contract for building a sewerage system was awarded to Cronin & O'Hara, of Pittsburg, for $7,226.50.

Maquoketa, Ia.—The contract for constructing a sewerage system has been awarded to the Iowa Construction company, of Clinton, Ia.

Elwood, Ind.—The contract for constructing three sewers was awarded, June 14, to Charles Fink, of Chicago, at 32 cents a lineal foot.

Melrose, Mass.—The A. W. Brynes Construction company, Boston, was awarded the contract, June 3, for sewer construction, for $20,020.05.

Valparaiso, Ind.—J. A. Madlem, of Goshen, Ind., was awarded the contract for constructing 4,000 feet of sewer in this city, for $2,000.

Indianapolis, Ind.—The contract for constructing a sewer in Southeastern avenue, was awarded to William Bossert, June 15, at $1.94 a lineal foot.

Easthampton, Mass.—George M. Atkins & Co., of Palmer, secured the contract for constructing new sewers on Payson and Williston avenues, for $1,568.

Cedar Rapids, Ia.—The contract for extending the Tenth avenue storm sewer has been awarded to Ford & De La Hunt, of this city, for $6,543.

Quincy, Mass.—The contract for constructing the first mile of the new sewerage system was awarded, June 4, to Charles G. Craib, of Boston, for $22,900.

Ann Arbor, Mich.—The contract for constructing a sewer in sewer district No. 6, was awarded, June 16, to Schneider Bros., of this city, for $9,987.85.

Colorado City, Col.—Contractor Ellis, of Kansas City, Mo., was awarded the contract, June 21, for constructing the sewerage system for about $6,500.

Worcester, Mass.—The G. H. Bushnell company of Thompsonville, Conn., secured the contract for building four large filter presses for the sewerage purification works in this city, for $18,250.

Bridgeport, Conn.—The Pierce Manufacturing company was awarded the contract, June 18, for building the Wilmot avenue sewer, at $6.09 a lineal foot, and B. D. Pierce, Jr., the contract for the Norman street sewer, at $5.19.

Elmira, N. Y.—Sewer contracts were awarded, June 14, as follows: Stowell street, 54 cents, and Hatch street, 51⅞ cents a lineal foot, John Walker; Church street, 87 cents, Timothy Connors; Sullivan street, 67⅜ cents, R. H. Walker.

Terre Haute, Ind.—The contract was awarded, June 15, for a sewer in Canal street to William Erler & Co., of Chicago, for $28,599.60, and in Hulman street to Thomas J. Peters and George C. Probst, of Chicago, for $75,502.

Wilmington, Del.—Sewer contracts were awarded, June 8, as follows: Market street, from Elliott avenue to Twenty-third street, Ruch & Co., $1,839.84; Freeman's Run, Ruch & Dehan, $20,590.13; Rattlesnake run, A. S. Reed & Bro. company, $18,296.45.

Albany, N. Y.—The contract for laying tile sewers through Watervliet avenue and Grant and Third streets was awarded to John Doyle, June 8, for $5,728.65, and June 22, a contract for constructing a tile sewer in Hamilton street, from Broadway to the river, for $1,577.70.

Hartford, Conn.—(Special.)—George Nevers, clerk of board of street commissioners, says the contract for constructing two 15-inch tile sewers in Wethersfield avenue was awarded to Michael O'Neil as follows: No. 1, 1,200 feet, 71 cents a lineal foot; No. 2, 2,000 feet, 76 cents a lineal foot; manholes, $31 each.

Solvay, N. Y.—Bids were received, June 19, for constructing a system of sewerage from twelve companies, which ranged in price from $20,613.35, the lowest, to $41,150.25. The lowest bid was presented by Nathan J. Conover of Freehold, N. J., and the highest by Baker & Banker of Gloversville, N. Y.

Iowa City, Ia.—(Special.)—Bids were received, June 4, for constructing three miles of sewers as follows: Fifth ward, Berry & Welch, Iowa City, $8,644.53; Ford & De La Hunt, Cedar Rapids, $8,113.80; M. V. Kennedy, Des Moines, $8,478.50; K. A. Smith & Co., Minneapolis, Minn., $7,950; William Horrabin, city, $7,709; Edward Walsh Construction company, Davenport, Ia., $6,573.80. First ward—Berry & Welch, $479.90; K. A. Smith & Co., $552.80; William Horrabin, $474.80; Thomas Hanlon, city, $340.60; Edward-Walsh Construction company, $413.40; Ford & De La Hunt, $398.80.

Jamestown, N. Y.—Bids were received, June 16, for constructing 21,000 feet of 30 to 15-inch outlet sewers as follows: B. U. Taylor, Olean, N. Y., pipe, $48,474; single ring brick, $40,479; double ring brick, $53,804. Prout & Swanson, Jamestown, pipe, $56,243; single ring, $50,380; double ring, $65,037. Jamestown Construction company, pipe, $54,961; single ring, $45,634; double ring, $49,498. Horace W. Walker, Jamestown pipe, $65,497; and Mitchell Construction company, New Castle, Pa., pipe, $52,249; single ring, $43,322; double ring, $58,912.

WATER-WORKS.

CONTEMPLATED WORK.

Caldwell, O.—A water works system is contemplated by the council.

Phoenixville, Pa.—The court is considering plans for securing a new water supply.

Stanley, Wis.—About a half mile of water mains will be put in this summer.

McHenry, Ill.—The village board contemplates the construction of a water works system.

Bristol, Va.—This city contemplates replacing 1,200 feet of 6-inch pipe with 8-inch pipe.

Prescott, Ariz.—Plans are being considered for a proposed permanent water supply. J. J. Fisher, city engineer.

Sacramento, Cal.—The enlargement of the water main in I street is recommended by Mayor C. H. Hubbard.

St. John, N. B.—The council contemplates putting in a new pump and making other improvements to the water works. William Murdoch, engineer.

Cedar Rapids, Ia.—The purchase of a new 5,000,000 gallon pumping engine is proposed. C. J. Fox, superintendent water works.

Orange, Tex.—Plans for a system of water works will be drawn by John Turner Smith, C. E., of Austin, Tex.

Washington, Ind.—New boilers, pumps and machinery will be added to the water works this summer.

Great Falls, Mont.—A committee has been appointed to report on purchasing the water plant or building a new one.

Adairville, Ky.—F. Wake and J. S. Millikan have been appointed a committee to get estimates on a water works system.

Melrose, Ill.—The subject of a joint water works system is being discussed by the village of this place and Maywood.

Fairport, N. Y.—The board of water commissioners has advertised for bids for laying several hundred feet of water pipe.

Hastings, Neb.—Bids will be advertised for installing a pumping plant at the city water works and other improvements.

Sodus, N. Y.—The town board is considering a proposition by a Syracuse syndicate for permission to establish a water works system.

The water works question will be voted on at the following places: Tamaqua, Pa., July 20; Ogden, Utah, July 13; Wadena, Minn., July 2; Monroe, N. C.

Tamaqua, Pa.—A special election will be held, July 20, to vote on increasing this borough's indebtedness $50,000 for the improvement of the water works system.

Ft. Dodge, Ia.—Press reports state that the condition of the city water is very bad, and steps should be taken at once by the council toward improving it.

Albany, N. Y.—Preliminary steps were taken, June 16, by the water commissioners toward securing the appropriation of $480,000 to construct the filter plant and purify the water supply.

Buffalo, N. Y.—The council will shortly advertise for bids for the new 30,000,000 gallon pumping engine, two new boilers, overhauling traveling crane, conduit and well for the water works.

Cumberland, Md.—The city council has decided to act at once on the recent recommendations of the water board looking to a pure water supply. The board recommends either sand filtration or Enett's creek as a source of supply.

Chicago, Ill.—The purchase of three new pumping engines is contemplated as follows: One 30,000,000 gallon pump at Chicago avenue station; one 30,000,000 gallon pump at Fourteenth street station; one 14,000,000 gallon pump at Sixty-eighth street station.

Wauwatosa, Wis.—Plans are being made for the establishment of a water works system.

Kearney, N. J.—A resolution was adopted by the common council, June 10, instructing the street committee to ascertain the cost of a new water supply.

The extension of water mains is contemplated at the following places: Macon, Ga.; Bloomington, Ill.; Memphis, Mo.; Sheldon, Ia.; Hillsboro, Tex.; Syracuse, N. Y.; Sioux City, Ia.; Red Wing, Minn.; Westport, Mo.; Fairmont, Minn.; Dubuque, Ia.

The construction of water works system is contemplated at the following places: Marseilles, Ill.; Kirkwood, Mo.; Frederica, Pa.; Tripoli, Ia.; Dexter, Minn.; Grand Ridge, Ill.; Edna, Tex.; Sabina, O.; Statesville, N. C.; Hayfield, Minn.; Orange, Tex.; Kildare, Okla.; Levis, Que.; Grand Forks, B. C.; Kaukauna, Wis.; Walker, Minn.; Monroeville, O.

CONTRACTS TO BE LET.

Chester, S. C.—Bids will be received until July 2 for a water works system. J. L. Glenn, commissioner.

Palestine, Tex.—This city invites capital to construct and operate a water works system. A. L. Bowers, mayor.

Brookhaven, Miss.—Sealed proposals will be received until July 27 for constructing a system of water works and electric lights. W. H. Seavey, city clerk.

Glenville, O.—Bids are asked until July 6

for laying a 6-inch water main in Colt road. T. C. Fisher, secretary water board.

Waterloo, Ill.—Bids will be received until July 9 for constructing a system of water works. Joseph W. Drury, chairman water works commissioners.

Pittsford, N. Y.—Sealed proposals will be received until July 2 for constructing water works. Paul D. Carpenter, president board water commisioners.

Holland, Mich.—Sealed proposals will be received until July 7 for furnishing a standpipe and foundation; certified check, $100. William O. Van Eyck, clerk.

Fosston, Minn.—Sealed proposals will be received until July 5 for constructing a water works system. Certified check 5 per cent. W. B. Sheffield, village recorder.

Lancaster, Pa.—Bids are asked until July 15 for furnishing and erecting four boilers for the water works. E. S. Smetz, mayor; E. R. Griel, clerk.

Columbia City, Ind.—(Special.)—Bids will be received until July 14, 1897, for the construction of a water works reservoir. C. B. Mattoon, city clerk.

Jefferson Barracks, Mo.—Sealed proposals will be received until July 14 for constructing a pump house and furnishing the necessary machinery. John F. Knight, captain.

Shreve, O.—Sealed proposals will be received until July 13 for furnishing and laying 2,800 feet of 4-inch cast iron water pipe, etc. Otto Troutman, chairman board trustees.

CONTRACTS AWARDED.

Wabash, Ind.—B. Murphy of this city was awarded the contract for constructing the water works system, for $5,108.

Halifax, Pa.—The contract for constructing waterworks was awarded to W. J. Fritz of Quarryville, Pa.

Sheffield, Mass.—The contract for erecting the water works system was awarded to C. L. Goodhue of Springfield, Mass.

Farley, Ia.—The Dubuque Construction Co., Dubuque, Ia., secured the contract for building the water works system in this city, for $3,700.

La Crosse, Wis.—The contract for laying a 6-inch water main on Moore and Loomis streets was awarded to R. F. Weston, for $1,029, June 12.

Port Gibson, Miss.—Sanders & Porter, of Louisville, were awarded the contract for constructing a water works and electric light plant for $23,950.

Michigan City, Ind.—The contract for the water works plant at the Indiana prison was awarded to M. H. Wheeler & Co., of Beloit, Wis., for about $15,000.

BRIDGES.

Pembina, N. D.—Bids are asked until July 7 for constructing several bridges.

Wessington Springs, S. D.—Bids are asked until July 5 for a steel bridge.

Newport, Me.—This town will issue bonds for a new steel bridge on Main street.

Tariffville, Conn.—A new iron bridge will be built over the Farmington river at Spoonville.

Beardstown, Ill.—Bids will be received until July 6 for a new steel bridge. Mayor Beatty.

Carthage, Mo.—The county court has been petitioned to build a bridge over Springs river, south of Adams' mill.

Goshen, Ind.—A new bridge will be built by the county commissioners to replace the one recently destroyed.

York, N. H.—The Bass Cove bridge, which was carried away by the flood, will be rebuilt by the selectmen at once.

Jefferson, Ill.—The Wrought Iron Bridge company, Canton, O., has been awarded the contract for three steel bridges in this town.

Diamond, Pa.—The county contemplates replacing the old bridge across the east branch of Sugar creek with an iron one.

Flandreau, S. D.—Bids will be received until July 6 for constructing two iron or steel bridges. H. W. Souther, county auditor.

Grafton, N. D.—Bids will be received until July 6 for constructing county bridges for a year. O. M. Fraser, county auditor.

Woodstock, Va.—The board of supervisors have appropriated $4,900 for building the bridge over the Shenandoah, near Edinburg.

Angleton, Tex.—Bids are wanted for a bridge 303 feet long, over Oyster creek, near this place. A. R. Masterson, county judge.

Monroe, La.—Bids are asked until July 10 for building a highway bridge over the Ouachita river. Mayor A. J. Herring, chairman bridge committee.

Frankfort, Ind.—The board of county commissioners decided, June 15, to build a bridge across Prairie Branch at Morrison street.

Florence, Col.—The Wrought Iron Bridge company, Canton, O., has been awarded the contracts for constructing the town bridges.

Granville, Ind.—The board of county commissioners has been petitioned to build a $20,000 steel bridge across the Wabash river.

Westerly, R. I.—The Wrought Iron Bridge company of Canton, O., secured the contract for a new iron bridge near Noyes' Beach for $1,397.

Beaver Falls, Minn.—Bids will be received until July 12 for constructing an iron bridge over Hawk creek. F. A. Schrader, chairman county commissioners.

Deer Park, N. Y.—The town board will ask bids for an iron bridge over the Neversink to take the place of the Guymard suspension bridge.

Oskaloosa, Ia.—The county board of supervisors of Mahaska and Keokuk counties has decided to build a bridge over Skunk river near Fremont.

Port Huron, Mich.—F. F. Rogers, city engineer, was instructed, June 21, to prepare plans and specifications for a bridge at Elmwood street.

Mt. Morris, N. Y.—The town boards of this place and of Leicester contemplate building a new highway bridge, but have not yet decided upon a site.

Binghamton, N. Y.—Bids are asked until July 12, for constructing bridges over the Chenango river at De Forrest and Ferry streets. Burr W. Mosher, city clerk.

Williamsport, Pa.—The grand jury has recommended new iron bridges over Little Pine creek, near English Center, and over Block House Ford, in Jackson township.

Goldbeach, Or.—Plans, specifications and sealed bids will be received until July 7 for a highway bridge across Hunter's creek. S. P. Pearce, county clerk.

Little Rock, Ark.—A site has been selected for a new bridge across Fourche Bayou, which is to be a part of a new free turnpike to be built around the Taylor pike.

Letcher, S. D.—The county commission-

ers are asking for bids for a steel bridge at Forestburg to replace the old wooden one carried away by high water.

Mt. Vernon, O.—Sealed proposals will be received until July 7 for a bridge superstructure over the Mohican river at Butler's ford; also, for masonry. W. A. Wander, county auditor.

Hillsboro, N. D.—Bids will be received until July 7 for constructing four steel bridges and several combination bridges; certified check, $1,000. George O. Stomner, county auditor.

Hackensack, N. J.—Bids are asked until July 8 for building a bridge with stone abutments, steel beams and brick arches near the Hillsdale station. John A. Eckerson, chairman council, Westwood, N. J.

Albany, N. Y.—Sealed proposals will be received until July 6 for constructing the steel superstructure of a viaduct at Knox street; also the masonry substructure. Thos. J. Lanahan, clerk.

Larmoure, N. D.—Bids will be received until July 8 for constructing a combination bridge across the James river, between Grand Rapids and Grand View townships. Chas. Allister, county auditor.

Orangeville, O.—Sealed proposals will be received until July 8 for the superstructure of an iron bridge over Pymatuning creek. Drawings, specifications, etc., must accompany bids. Geo. E. Hamilton, clerk.

Columbus, O.—Sealed proposals will be received until July 7, for building the superstructure and paving the Big Run bridge on the Jackson pike, Franklin township; also, constructing substructure and approaches. W. H. Halliday, county auditor.

Spartanburg, S. C.—Bids will be received July 7, for a bridge at Collins Ford; July 8 for the Whitney bridges; July 9 for the two bridges over Enoree river at Sandy Ford and Musgrove Mills. Bids will be received for both wooden and steel bridges. County superintendent Howell.

Zanesville, O.—Sealed proposals will be received until July 20, for the superstructure of an iron or steel highway bridge across Jonathan's creek, near Fultonham in Newton township. Bidders are to furnish their own plans, specifications, etc. James L. Starkey, county auditor.

Jefferson City, Mo.—Plans will be received until July 12, for a steel bridge, 200-foot span, with a sixty-foot girder or truss span at each end. A plan will be selected and the contract for building the bridge will be let publicly July 13. H. S. Dewey, commissioner roads and bridges.

PARKS.

Ottumwa, Ia.—A new park is proposed.

Berkeley, Cal.—The West Berkeley Improvement Club is agitating the question of a public park for this town.

Cleveland, O.—The park board has been directed to purchase the remainder of the land in Denison avenue and make a fine entrance to the park.

Meriden, Conn.—The Charles Parker company has donated this city all their land on the north side of Southington avenue for park purposes.

Herkimer, N. Y.—This town has voted favorably on the proposition to appropriate $2,500 to convert the old cemetery at the west end of Liberty street into a public park.

Jamaica (L. I.), N. Y.—A committee was appointed by the board of village trustees, June 18, to examine into the matter of purchasing property for public park purposes.

Chester, Pa.—Samuel A. Crozier has presented this city with another park joining the one which he gave it several years ago, and has engaged a landscape gardener to lay it out.

Newark, N. J.—The heirs of Aaron Peck, deceased, have had conveyed to the park commission a tract of land on Bloomfield avenue within the limits of the Branch Brook Park.

Cambridge, Mass.—The park commissioners have been petitioned for an appropriation to purchase a portion of "Elmwood" adjoining the Lowell homestead, to be preserved as a memorial park of James Russell Lowell.

Buffalo, N. Y.—Sealed proposals will be received until July 6 for work in the parks, consisting of excavation, cut stone work, construction of basins, fountain, walks, etc. G. H. Selkirk, secretary board park commissioners.

New York, N. Y.—This city is empowered to spend $1,000,000 a year for sites for small parks, and for the purpose of selecting these sites a committee has been announced to act with Mayor Strong in an advisory capacity as follows: Ex-Mayor Abram S. Hewitt, chairman; W. R. Stewart, DeWitt J. Seligman, Meyer S. Isaacs, James J. Higginson, the Rev. John B. Devins, Dr. J. B. Bryant and Jacob A. Riis.

STREET CLEANING AND SPRINKLING.

Kansas City, Mo.—This city will adopt the bag carts for street cleaning.

Newport, R. I.—The board of health has recommended the disposal of garbage by cremation.

Burlington, Vt.—The purchase of an additional street sprinkling wagon is contemplated.

Syracuse, N. Y.—The common council voted, June 21, to clean the brick and asphalt pavements by flushing.

Omaha, Neb.—The board of public works is considering the question of street sweeping, and it may conclude to adopt horse sweepers.

Cleveland, O.—Bids will probably be asked soon for the Holthaus system of garbage disposal, specifications for which were adopted by the council June 14.

New Haven, Conn.—The board of public works awarded the contract for sprinkling the streets, June 23, to the New Haven Street Sprinkling company at prices ranging from $316.20 per mile for a 15-foot street to $1,160 for a 65-foot street, with one-sixth additional for sprinkling on Sunday. This bid was $3,100 lower than the bid presented by Frank Brazos, the only other bidder.

Washington, D. C.—(Special.)—The contract for street cleaning was awarded to Daggett & Dugan, under a compromise arrangement to give the more important streets to hand labor, at a bid of 32 cents per 1,000 square yards, the remaining streets to be swept by side-sweeper machines, price, 25¾ cents per 1,000 square yards.